final report

IITRI

DESIGN AND DEVELOPMENT
of
# A COLLAPSIBLE FOLDING CANE
for

Dept. of Health, Education and Welfare
Social and Rehabilitation Service
Washington, D. C.

IIT Research Institute

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.I58
1969

DESIGN AND DEVELOPMENT
of
A COLLAPSIBLE FOLDING CANE
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Dept. of Health, Education and Welfare
Social and Rehabilitation Service
Washington, D. C.

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"DESIGN AND DEVELOPMENT OF A COLLAPSIBLE FOLDING CANE"

IITRI Project No. J6048
(Formerly Project No. K6120)

Contract No. SAV-1058-67

for

Department of Health, Education and Welfare
Social and Rehabilitation Service
Washington, D. C.

January 21, 1969

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FOREWARD

This Final Report is submitted to the Department of Health, Education and Welfare Social Rehabilitation Service, regarding Contract No. SAV-1058-67, "Design and Development of a Collapsible Folding Cane".

Contributors to the contents of this report include: R. Barnett, S. Bazell, R. Pape, and W. E. Reynolds.

Respectfully submitted,

IIT RESEARCH INSTITUTE

S Bazell

S. Bazell
Bio-Medical Engineer

APPROVED:

W. E. Reynolds

W. E. Reynolds
Manager
Medical Engineering Center

ABSTRACT

This Final Report describes the design, development, and field evaluation results of a folding cane used for "traveling" by the partially sighted or sightless person. The work was conducted during the period beginning May 1, 1967 to December 31, 1968, under Contract No. SAV-1058-67 for the Social Rehabilitation Service of the Department of Health, Education and Welfare.

Several experimental cane designs were investigated under the program. These experiments culminated in two (2) prototype designs. One hundred canes were fabricated and sent to ten (10) facilities including the Social Rehabilitation Service office in Washington, D. C. for test and evaluation. The results of the evaluations are tabulated in this report. Recommendations for further cane development and subsequent manufacture are also presented. Drawings of cane components are included in Appendix A.

I. INTRODUCTION

The principal function of a cane for the partially sighted or sightless person, is to probe and relate to the user the ground structure of the environment. This tactile signal, coupled with a knowledgeable interpretation of echoes and other sounds around him, furnishes the blind "traveler" with an adequate mental map of where to proceed with reasonable safety. Present techniques of teaching people how to use the cane places great importance on making it an extension of the arm, or more particularly, the index finger. For this reason, therefore, the cane, except in emergencies, is not used for anything more than a sensing device.

A. Design Objectives

The "long-cane" technique of travel, in extensive use at present, allows for comparatively fast mobility - especially in familiar environment. It should be light and easily maneuverable without being whippy, able to withstand repeated bending stresses without permanent deformation, and for both utilitarian and psychological reasons, capable of being stored conveniently in a man's pocket or a woman's handbag. The cane should be closely competitive, price-wise, with other types of canes being used, and present a longer useful life, thereby making it less expensive than others over a period of perhaps 2 to 3 years.

With these objectives in mind, IITRI undertook the subject program, Contract No. SAV-1058-67, to design and develop a collapsible or folding cane. These canes were field tested and evaluated at 10 facilities located in various sections of the United States. The results of the field tests are tabulated in a later section of this report.

II. DISCUSSION

There are three (3) types of canes now in use or under development: the straight cane composed of a solid rod or tube, with or without a curved handle; the telescoping cane, where each segment slides into another; and the collapsible or folding cane. These latter canes, with the exception of the IITRI designed canes, are made up of segments whose ends telescope into one another. They utilize an elastic or non-elastic central cord, mainly to hold the segments together, the stiffness or rigidity being derived from the close fits of the telescoped ends. The main problem area with these canes stems from the fact that with normal use, the diameters of the fitted segments eventually become enlarged, thus giving the cane undesirable movement between the loosened segments. Weight and size limitations necessitate using a very thin-walled tube for the segments of these canes. Any abnormal bending stresses applied to the cane tend to enlarge the socket portion of the segment, thereby leading to progressive loosening of the joints, and subsequent "rattling" in use. Should a very high bending load occur, the sockets become very large and also catastrophic failure of the cane takes place through buckling of the segments. Another problem area with this type of cane is the cord which holds the segments together. In a folded condition, the cord, (elastic or non-elastic) is stretched over the sharp edge of the ends of the thin-walled segments. The cord surface becomes progressively frayed, until subsequently, the cord breaks.

III. CANE DESIGN AND DEVELOPMENT

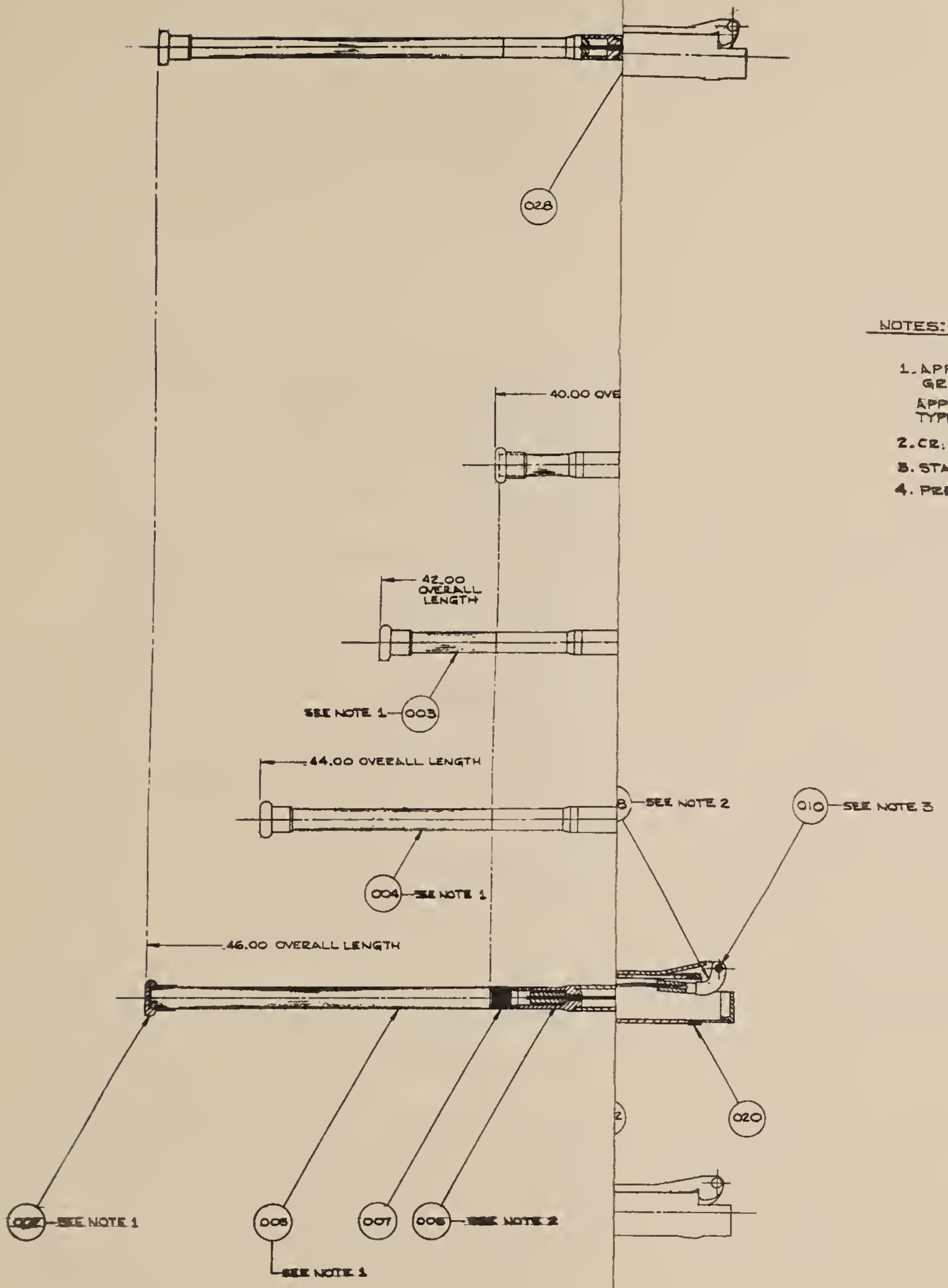
A. Short Segment Cane

The initial cane design was based on a series of very short segments butted together and held in place by a cable running through the common longitudinal center line, Fig. 1. Tensioning or pre-stressing the cable determined the stiffness of the resultant column. There were several disadvantages to the use of these short segments such as:

1) Considerable flexibility, even with very high cable stress.
2) When breaking the cane for storage, it tended to roll circularly rather than fold into a convenient shape.
3) To increase stiffness appreciably, the cable would require not only very high stressing, but the diameter of the segments would also require an increase, thereby making it bulky.
4) The many segments required for each cane would mean higher manufacturing and assembly costs.

B. Long Segment Cane

Subsequent to the experiments with the above cane, another was designed utilizing a basic segment length of 7 15/16 inches, Fig. 2 and 3. This length was found to be most suitable in terms of making a small enough package to fit into a man's pocket or a woman's purse. Several cane diameters were experimented with based on calculations to give an indication of the stiffness and forces required. To determine the factors influencing both cable and cane diameters, the following assumptions were made: for example, for a 1/2 inch diameter



NOTES:

1. APPLY LOCQUIC PRIMER GRADE G
   APPLY LOCTITE SEALANT TYPE HV, COLOR-BROWN
2. CRIMP CABLE SECURELY
3. STAKE RIVET SECURELY
4. PRESS PLUG IN FLUSH

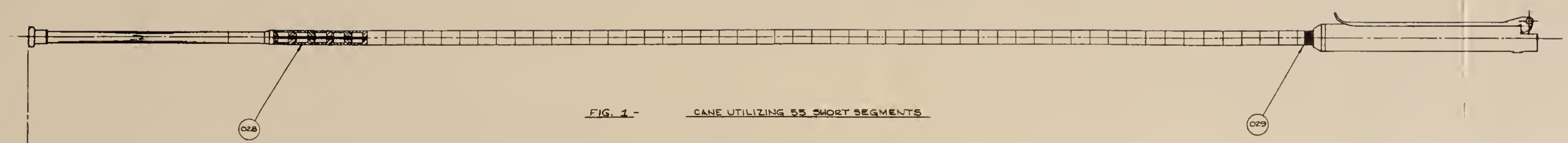
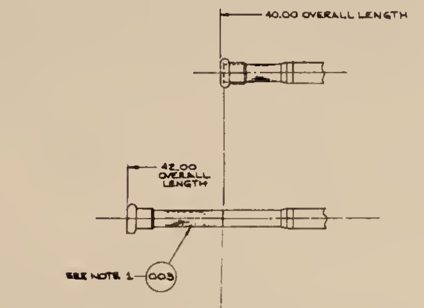


FIG. 1 - CANE UTILIZING 55 SHORT SEGMENTS



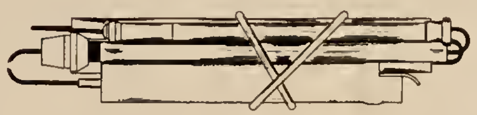


FIG. 3 - CANE IN FOLDED POSITION

NOTES:

1. APPLY LOCQUIC PRIMER GRADE Q
   APPLY LOCTITE SEALANT TYPE HV, COLOR-BROWN
2. CRIMP CABLE SECURELY
3. STAKE RIVET SECURELY
4. PRESS PLUG IN FLUSH

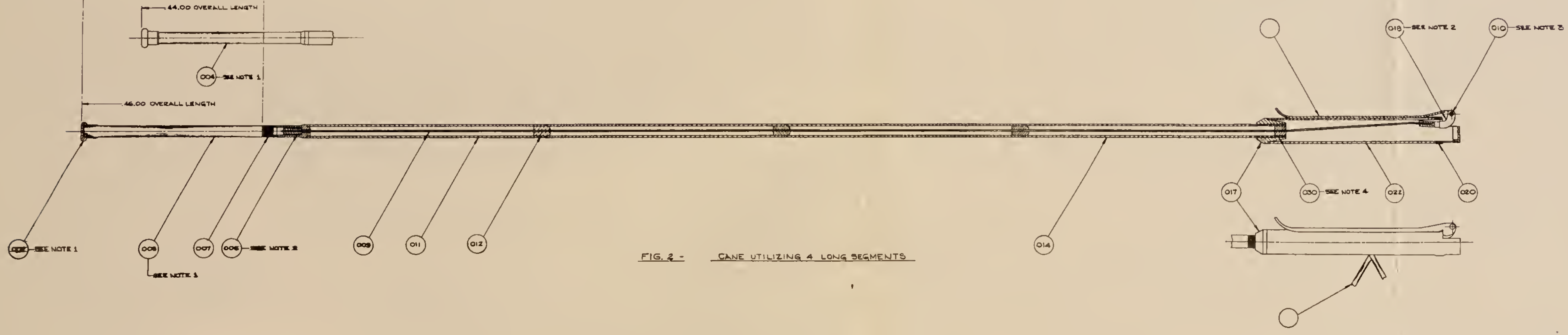


FIG. 2 - CANE UTILIZING 4 LONG SEGMENTS

cane, the tension in the cable would have to be 4200 pounds according to the formula:

$$F = \frac{PL}{2d}$$

$$Fr = \frac{100 \text{ lbs. X } 42 \text{ inches}}{2 \text{ X } \frac{1}{2} \text{ inch}} = 4200 \text{ lbs.}$$

where

Fr = force required to resist the bending load P exerted at right angle to the longitudinal center line of the cane.

d = diameter of the cane

L = length of the cane

A single cable to withstand this tension, without the added stress on it from deflection of the cane, would have to be better than 3/16 diameter. This diameter cable would be difficult to ready the cane for use, and most difficult to lock against this tensile force.

Calculations and subsequent experiments with the several parameters le to the design of the basic 40 inch long cane (required by contract) and a 7/16 inch diameter. A deflection force, P, of 10 pounds was assumed to be more reasonable, since this cane is not required to act as a supportive device. According to the formula above, the resistive force F_r therefore would be 480 pounds. Allowing for some flexibility and ease of locking the cane, it was found that 1/16 inch, 7 x 7 preformed air-craft cable was most suitable in terms of elongation, and ease of folding and unfolding. The cable was held in the fittings without slippage when the swaging force exerted on the fittings was between 14 and 16 tons. These canes were fabricated in 40, 42, 44 and 46 inch lengths. A total of 100 canes were made, 12 of which were the short segment type.

IV. CANE EVALUATION

A. Evaluation Facilities

A list was received from Mr. G. Magers of Washington, D.C. office of Social and Rehabilitation Service, composed of nine (9) facilities in addition to the Washington office indicating where these canes should be shipped for evaluation. The original list of facilities was as follows:

Illinois Visually Handicapped Institute
1151 South Wood Street
Chicago, Illinois
Attn: Mr. Thomas J. Murphy, Superintendent
(Area Code 312) 341-8000

Western Michigan University
Kalamazoo, Michigan
Attn: Mr. Donald Blasch, Director
(Area Code 616) 383-1681

Bureau for the Blind
Division of Welfare
3525 Watson Road
St. Louis, Missouri
Attn: Mr. John B. Raithel, Director
or Mr. Albee
(Area Code 314) 645-8911

Kansas Rehabilitation Center for the Blind
Topeka, Kansas
Attn: Mr. Lowell Holland, Director
(Area Code 913) CE-4-2631

Chicago Lighthouse for the Blind
1850 West Roosevelt Road
Chicago, Illinois
Attn: Mr. William O. McGill, Director
(Area Code 312) 666-1331

The Arkansas Enterprise for the Blind, Inc.
2811 Fair Park Boulevard
Little Rock, Arkansas
Attn: Mr. Ray Kumpe, Executive Director
(Area Code 501) MO-6-9406

Illinois Braille and Sight Saving School
658 East State Street
Jacksonville, Illinois
Attn: Mr. Jack R. Hartong, Superintendent
(Area Code 217) 245-4101

Greater Pittsburgh Guild for the Blind
5231 Centre Avenue
Pittsburgh, Pennsylvania
Attn: Dr. Leon Reid, Director
(Area Code 412) 221-2200

Rehabilitation Center for the Blind
Hines Hospital
Hines, Illinois
Attn: Mr. John Malamazian

The canes were shipped to those indicated on the above list. One facility, Hines Hospital, returned the canes stating that the shortest cane they could tolerate was 48 inches long. Since no canes were fabricated over 46 inches, except in a few special instances, another facility was substituted for Hines Hospital, namely, Cleveland Society for the Blind, 1909 East 101st Street, Cleveland, Ohio, 44106, Attention Mr. Cleo Dolan, Director. The following set of instructions and a short questionnaire accompanied each cane. The tabulated results of the questionnaire are shown in Table I.

INSTRUCTIONS

To the recipient of the IITRI Prototype Cane:

The cane you have just received for evaluation has been designed to fold into a size small enough in volume to be carried conveniently in a normal size pocket or a woman's purse.

The following simple instructions will help you to ready the cane for use or to stow it most effectively: Figs. 4, 5, 6, 7, 8, and 9.

1) If you have received the cane in a folded position, first unwrap the elastic cord holding the cane segments together. Hold the handle with one hand in a vertical position allowing the cane segments to fall free. With the other hand pull the

lever, now stored in the handle, up to its limit. Fold the lever down until it rests snugly against the handle (this will mean that you have rotated the lever around the hardened lock ring in the top of the handle a full 180°). This action will impart a tension to the cable running throughout the center of the cane and will lock all of the segments into proper position to stiffen the cane.

2) To fold the cane, hold the cane horizontal with one hand at the bottom segment and the other hand holding the locking lever. Unlock the lever by swinging it upward; this releases the tension in the central cable. While still holding the lever in the one hand, start folding the cane at the bottom or tip segment working your way with each fold toward the handle. This procedure will insure that enough cable is allowed for folding of the segments. When the handle is reached it can be folded back to rest against the cane segments. In this position the elastic wrist cord can be used to bind all of the sections together.

These canes have been adjusted for stiffness. However, should greater or lesser flexibility be desired, the following procedure should be followed:

1) At the uppermost segment there is a round nut which is threaded to that particular segment. Turning this nut (clock-wise) will in effect decrease the tension on the central cable thus allowing for more flexibility when the cane assembly is locked into traveling position. It is not advisable to increase the tension on the central cable greater than that in the received condition. However, if more tension is desired it can be accomplished by turning the adjusting nut in a counterclockwise direction.

Instructions (continued)

You will find enclosed with these instructions a questionnaire which we hope you will complete after you have made several judgments and have assessed the value of this cane. We would appreciate your filling out this questionnaire and returning it to the person responsible for giving you the cane. These comments and any others you might wish to add will help us in further development of a cane which will be universally acceptable for effective traveling.

TABLE I

QUESTIONNAIRE

COLLAPSIBLE CANE

	YES	NO
1. Is the weight of the cane satisfactory.	(35)	(17)
2. Is the cane easy to handle in its folded condition.	(31)	(22)
3. Is the cane easy to unfold and prestress for use.	(36)	(17)
4. Is the rigidity of the cane satisfactory.	(33)	(19)
5. Is the shape of the handle satisfactory.	(38)	(14)
6. Can you identify objects with respect to material through:		
a) sound transmitted	(21)	(28)
b) feel through touching with tip of cane	(22)	(28)

7. Compared to other canes you have used is this cane:

a) Superior 8
b) Equal 14
c) Inferior 31

After the several personal visits, the high number of 7,C, above, was mainly attributed to the initial impression the person received from the cane if he or she were not first properly instructed in its operation. This number is not an apparent reflection of answers to questions 1 through 5 which answers affirmatively approximately 2 to 1.

B. Evaluation Comments

If one were to study only the results of the answers to the questionnaire, the evaluation might show that the IITRI cane offered no really impressive advantages over the existing folding canes. However, personal visits to several of the evaluating facilities, and phone conversations with others, indicated that the cane (long-segment type) showed definite improvements over other canes. Several facilities were visited personally, and are listed below:

- Illinois Visually Handicapped Institute
- Western Michigan University
- Bureau for the Blind, St. Louis, Missouri
- Chicago Lighthouse for the Blind
- Illinois Braille and Sight Saving School

A very important aspect of all the visits was that, regardless of how complete written instructions could be, a more favorable initial impression of the cane could be achieved by demonstrating to the person involved how to fold and unfold the cane. In all cases, this took no more than two minutes. Although a wide variety of opinions were expressed through the questionnaires and additional comments and recommendations, most mobility instructors were inclined to be favorably impressed by the cane. In fact, there were only two universal adverse reactions: 1) the tip was too noisy and 2) a better wrist strap was needed, especially to hold the cane in its folded position.

With regards to (1) above, it should be stated that personnel at IITRI were aware of this, however it was decided to send the canes out for evaluation to receive comments about the "noise". It was felt that to achieve a good loud sound was more difficult, and that should noise attenuation be desired, a nylon tip can be easily substituted for the steel tip. The

B. Evaluation Comments (continued)

nylon tip is shown as an alternative to the steel tip in drawing No. K6120-A-002-1 in Appendix A of this report.

Of all the canes experimented with, both al IITRI and at the facilities recommended to carry out the evaluations, four (4) were rendered unusable because of broken center cables. Upon investigation of the reasons for the breakage, it was learned that the people handling these canes were, in one instructors' words, "over-exhuberant" in their testing. That is, the canes were bent far beyond their limits, and the cables broke. One student actually bent the cane over his knee until the cable broke.

We have chosen two evaluation summaries from cognizant personnel to include in this report. Exhibit A is a report by Mr. Paul Taviani, mobility instructor of the Illinois Visually Handicapped Institute, Chicago, Illinois, and Exhibit B, a report from Mr. G. A. Magers, Assistant Chief, Division of Services to the Blind, Washington, D. C. These reports contain comments which are typical of those made by other facilities evaluating the canes.

V. RECOMMENDATIONS

The present long segment cane, from an engineering and manufacturing standpoint, and from the impressions received from mobility instructors and their students, seem to offer definite advantages over those canes presently on the market. With normal use, indications are that 1) they will last much longer, 2) they are cosmetically acceptable, especially to the female, 3) they retain their stiffness, without "rattling", indefinitely, 4) if bent excessively, there is no permanent deformation restricting further use, 5) the stiffness is adjustable to suit the user's requirements, 6) if accidentally broken, the whole cane need no be discarded, but only the

Progress Report
Evaluation on I.I.T. Cane

General Comments: This cane, with certain imperative adaptations, could be a valuable and widely used travel aid for blind people. Unfortunately, at this time our evaluation is not as comprehensive or as valid as we would like it to be; however, we are able to see that the cane definitely has the rigidity and strength that a collapsable cane needs for total orientation and mobility uses.

We are unable to implement the canes fully because of several reasons. The canes are not equipped with a nylon or plastic type of replaceable tip. The metal tips "grip" into sidewalks and paved areas. This causes a complete breakdown in long cane technique. The metal tip is not capable of determining as effectively as the nylon tip the differences in texture of terrain and the variations in auditory stimuli produced by the sound of the cane touch. During indoor travel, the metal tips produce an extremely loud and discomfortable sound.

In addition to the problem of the tip, the cane lengths also prevented us from utilizing the canes in our regular program. In a good mobility program, cane length is determined on an individual basis. The trainee or student's height will determine the length of his cane. Most of our students were too tall for the canes we were given to evaluate (of course, in our summer program for school children we did not have too much of a problem since these children were shorter than the adults we normally teach).

Normally we would evaluate a cane by letting one or more of our trainees or staff members use the experimental cane while being taught the skills and techniques of travel or if it is a staff member, he would use the cane to and from work and during any travel he may do. But because of the problems mentioned above we could not do this since the trainees would not have been able to benefit from instruction fully and none of the staff members cared for the type of tip on the cane. So we could only start a limited evaluation program.

Procedures: During our summer program, three students used the canes on four lessons each. This was done to get their initial reactions and have them test it while walking on lessons. Fifteen of the students tried opening and closing the canes (this was done so that we could find out if the students would have a hard time figuring out how the locking and release mechanism worked). Three students in our regular program tested the cane for its durability concerning opening and closing and the canes ability to take shock! The cane was tested for shock in three ways: first its ability to remain rigid while being used in the touch technique when walking, secondly, its ability to take the jamming effect of hitting stairs and curbs, and third, the canes ability to take special and infrequent blows such as being stepped on and jarred lose from the hand. In addition to these students testing the cane, a mobility instructor also used the cane under the blindfold to test it out while walking, crossing streets and checking its strength against the shocks discussed above. We also showed the cane to many of the students and staff and asked them for their reactions.

Exhibit A

Results: Everyone who tested the cane found it to be strong and capable of taking shock. It is flexible enough to absorb shock and yet it snaps back into place as rigid as before. Two of the canes were opened and closed over two hundred times and their locking mechanisms showed no sign of breaking down. The canes showed no wear from being dropped or jammed. Only one cane broke as a result of testing. This occurred when the cane was stepped on rather vehemently several times by an over-enthusiastic tester. However, it can be stated that the canes do hold up under average and above average cane stress.

One interesting note is that most of the people who tried opening the cane and closing it (locking and unlocking) did not have much trouble learning how to do it. At first glance, this would have seemed to present a problem to blind people. The only people who had trouble locking the cane were the girl summer students. Some of them thought that the lever was too hard to push down, but the older students did not have any trouble.

Most of those using the cane said that the grip was alright and that it presented no significant problems. Most of the complaints were about the tip and the noise it produced. Everyone was in agreement that the cane's rigidity was good.

Conclusions

Up to this point, we have evaluated the cane as far as possible considering the canes obvious drawbacks. We would like to field test the cane by incorporating it into our program, but there must be modifications built onto the cane. If the cane were to be constructed in longer lengths and the tip be replaced with a nylon type we would be able to give a completely thorough and valid evaluation. The cane has shown great strength and durability as far as the shaft construction and locking mechanism is concerned in special tests. In addition to this, the cane is cosmetically attractive and folds to a small size that is very convenient to put away when not in use.

Unfortunately, we cannot say how the cane will hold up with daily use over a prolonged length of time. If these improvements mentioned above can be implemented, the cane will undoubtedly be of great value towards the improvement of orientation and mobility for the blind.

Paul Taviani
Mobility Instructor
IVHI

Exhibit A continued

DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
SOCIAL AND REHABILITATION SERVICE
WASHINGTON, D.C. 20201

REHABILITATION SERVICES
ADMINISTRATION

October 21, 1968

Mr. William E. Reynolds
Assistant Director
Illinois Institute of Technology
Research Institute
10 West 35th Street
Chicago, Illinois 60616

Attention: Mr. Seymour Bazelle

Dear Sir:

In accordance with our recent telephone conversation we have collected comments on the collapsible cane which you sent to this office.

In summary, they are as follows:

1. This is an extremely effective collapsible cane with respect to its rigidity. The sections hold well and it does not become damaged if it is bent by someone stepping on it or is accidentally caught in a fence or stair railing.

2. The comments on the tension mechanism have been favorable since it can be adjusted to obtain different degrees of rigidity.

3. The elastic band to keep the cane together when it is collapsed has not held up under use. In the majority of instances it has become loose. However, this can be remedied by working the ends of the band back through the hole and down the barrel of the handle until it is visible, thus, tying a knot in it. This seems to hold better than the original.

4. All of the users have been concerned with the tip of the cane. A glide tip is preferable and by drilling and tapping the last section of the cane which is solid, a standard glide tip can be used.

5. There has been some concern with the noise of the cable vibrating against the wall of the cane when it is in use.

6. It appears that the rubberized material on the grip of the cane does not stand the test.

Exhibit B

7. One user suggested that perhaps the sections could be slightly longer, thus, making the cane easier to collapse.

The comments listed above represent the different opinions of at least eight users.

Sincerely yours,

George A Magers

George A. Magers, Assistant Chief
Division of Services to the Blind

Exhibit B continued

component which is broken, and very important, 7) in mass production, it is believed that the cost will be most competitive with present canes.

A. Further Work

There are several improvements which can be made to the cane. They are:

1) Thin-tube swaging techniques to lighten the segments, while still retaining necessary column stiffness.
2) Use of primers in conjunction with Plastisol coatings for the lever and handle for better adhesion.
3) Molded (not machined) reinforced nylon or other good wear property synthetic material for the tip.
4) Improved method of attaching wrist band to handle.
5) Plastic coating for prestressed cable which would eliminate some undesirable noise of vibration throughout column.
6) Redesign of basic cane length of at least 44 inch length.
7) Redesign of handle into one part, rather than three parts to reduce cost of assembly. This may be accomplished by swaging techniques. There are several companies with advanced expertise in this respect. IITRI has already been contacted by the LeFiell Manufacturing Company of Santa Fe Springs, California. A letter indicating this company's desire to work with IITRI on a program is included in this report as Exhibit C.

VI. CONCLUSIONS

We have ascertained that the collapsible cane developed at IITRI for the Social Rehabilitation Services, by consensus, will be generally quite acceptable to the visually handicapped person as an aid in traveling. There have been many requests,

LE FIELL SPORT PRODUCTS, INC.

13635 ALONDRA BOULEVARD

SANTA FE SPRINGS, CALIFORNIA 90670

ALCOA

(213) 773-9177
(213) 921-4020

August 30, 1968

Mr. Symour Bazell
Program Manager
ILLINOIS INSTITUTE OF TECHNOLOGY, RESEARCH INSTITUTE
10 West 35th Street
Chicago, Illinois
60616

Dear Mr. Bazell:

It has been brought to our attention that you are presently involved as program manager in the development of an aluminum alloy cane, collapsible in design, for use by the blind. We wish to express an intense interest and desire to work with you and your department in the development of such an item if at all possible.

To better acquaint you with our manufacturing capabilities, we are enclosing a LeFiell Manufacturing Company catalog that will give you a much greater insight then any letter I could possibly dictate.

To better acquaint you with LeFiell Sport Products, Inc., we are a jointly owned sport products manufacturing company presently engaged in the manufacture of aluminum alloy golf shafts, billiard cues and ski poles. The Aluminum Company of America owns the controlling interest and LeFiell Manufactuing the minority interest. Since our companies have been leaders in the development of high strength, precision tubular products, both for the aircraft and aerospace industry, as well as the sporting goods industry, it is our feeling that we are exceedingly compentent in the aeras in which you are now working.

An early reply will be greatly appreciated, as we are quite anxious to be of any assistance possible in this fine program.

Very truly yours,

LE FIELL SPORTS PRODUCTS, INC.

Daniel H. Sheehan/sn

Daniel H. Sheehan
Vice President - Marketing

DHS/sn

Exhibit C

from diverse sources, for canes to be furnished individuals, and requests for permission to manufacture these canes. When shown how to use it, individuals young and old, male and female, find it easy to fold and unfold. It has been shown to be durable, competitive in price, and cosmetically acceptable. The short-segment cane was not acceptable to the majority of users. The two main objections were its flexibility (only 3 persons liked this feature) and the fact that it was difficult to fold into a compact shape.

Personnel at IITRI have enjoyed working on this worthwhile program for the visually handicapped, and look forward to being of further assistance to the Social Rehabilitation Services.

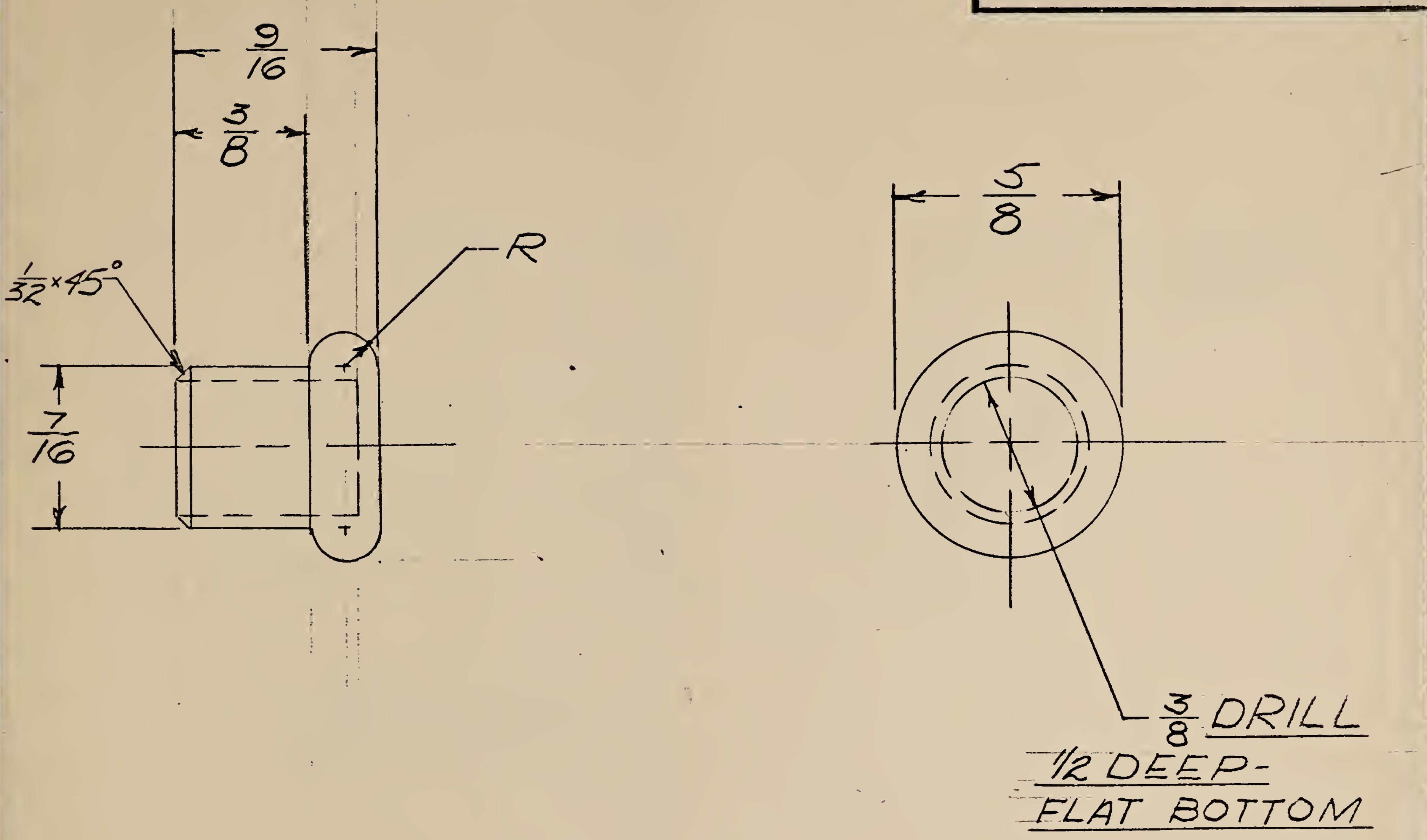
APPENDIX A

APPENDIX A

The following drawings represent the basic component parts of both the long and short segment canes, which were fabricated during the program.

DRAWING NO.	TITLE
K6120-A-002	TIP
K6120-A-002-1	TIP, REVISED
K6120-B-003, 004 and 005	EXTENSION, TIP
K6120-A-006	ASSEMBLY, TIP & EXTENSION
K6120-B-007	SEGMENT, TIP
K6120-A-008	FITTING, SWAGE
K6120-A-009	CABLE
K6120-A-010	RIVET
K6120-B-011	SEGMENT, LONG
K6120-A-012	INSERT
K6120-A-013	INSERT/SEGMENT ASSEMBLY
K6120-B-014	SEGMENT, TOP
K6120-A-017	NUT, ADJUSTMENT
K6120-A-018	SWAGE FITTING, ELBOW
K6120-B-019	HANDLE
K6120-A-020	RING, WEAR
K6120-A-021	CAP
K6120-B-022	HANDLE & CAP ASSEM.
K6120-B-023	LEVER, (REVISION)
K6120-B-023-1	LEVER (PRESENT)
K6120-A-028	SEGMENT, SMALL
K6120-A-029	SEGMENT - TOP, SHORT
K6120-A-030	PLUG
J6048-R-001	ASSEMBLY, LONG & SHORT SEGMENT CANES (Shown in Text as Figs. 1, 2, & 3 on Page 5)

-A-



NOTE: THIS DRAWING SUPERCEDED
BY K6120-A-002-1 FOR NOISE
ATTENUATION

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SYM.	DATE	DESCRIPTION OF REVISION	NAME

IIT RESEARCH INSTITUTE
TECHNOLOGY CENTER CHICAGO, ILLINOIS 60616

MATERIAL 1020 CRS

HEAT TREAT

TIP

TOLERANCES
UNLESS OTHERWISE SPECIFIED
FRACTIONS ± 1/64 DECIMALS ± .005
THDS CLASS 2 FIT ANGULAR ± 1°

DO NOT SCALE - REPORT ERRORS
BREAK ALL SHARP CORNERS
C'SINK ALL TAPPED HOLES 1/32 x 45°
REMOVE BURRS

FINISH 64 ∇ UNLESS OTHERWISE NOTED

QUANTITY PER
3 SUB-ASSEMBLY

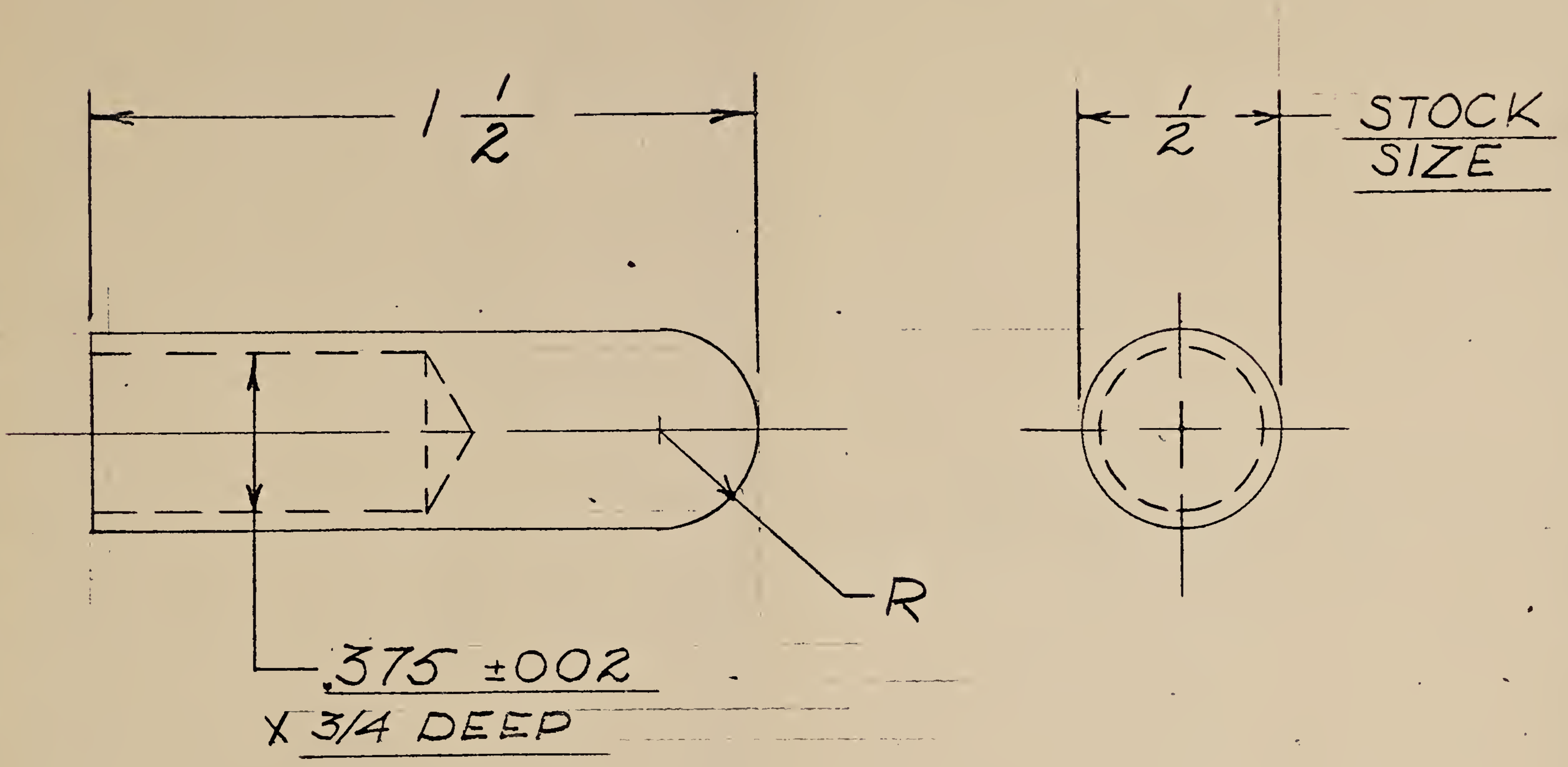
	DESIGNED	DRAWN	CHECKED	APPROVED
NAME	AB	AB	WK	
DATE	30 Oct 67			

SCALE 2:1

NEXT ASSEMBLY NO.

PROJECT DRAWING NO. K6120-A-002

-A-



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SYM.	DATE	DESCRIPTION OF REVISION	NAME

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MATERIAL NYLON - (MOLD IN PRODUCTION)

HEAT TREAT

TIP, REVISED

TOLERANCES
UNLESS OTHERWISE SPECIFIED
FRACTIONS ± 1/64 DECIMALS ± .005
THDS CLASS 2 FIT ANGULAR ± 1°

FINISH
UNLESS OTHERWISE NOTED

QUANTITY PER

SUB-ASSEMBLY

	DESIGNED	DRAWN	CHECKED	APPROVED
NAME	AB	AB		
DATE		4 Nov.68		

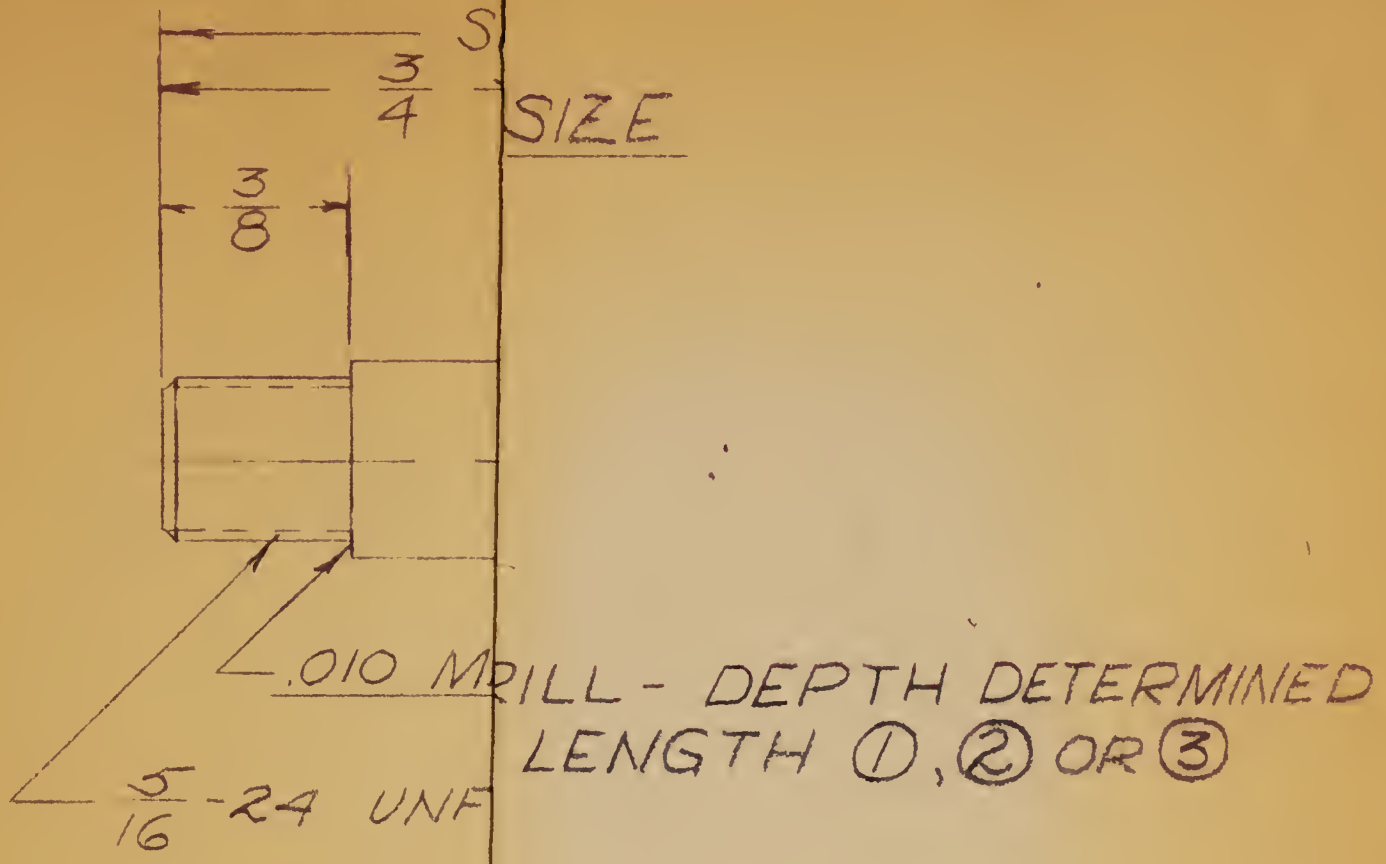
DO NOT SCALE - REPORT ERRORS
BREAK ALL SHARP CORNERS
C'SINK ALL TAPPED HOLES 1/32 x 45°
REMOVE BURRS

SCALE 2:1

NEXT ASSEMBLY NO.

PROJECT DRAWING NO. K6120-A-002-1

-B-



NOTE: THIS PART R

① K6120-B-0

② K6120-B-0

③ K6120-B-0

BRIGHT RED

STRAIGHT KNURL	SB.
DESCRIPTION OF REVISION	NAME

RESEARCH INSTITUTE
CENTER CHICAGO, ILLINOIS 60616

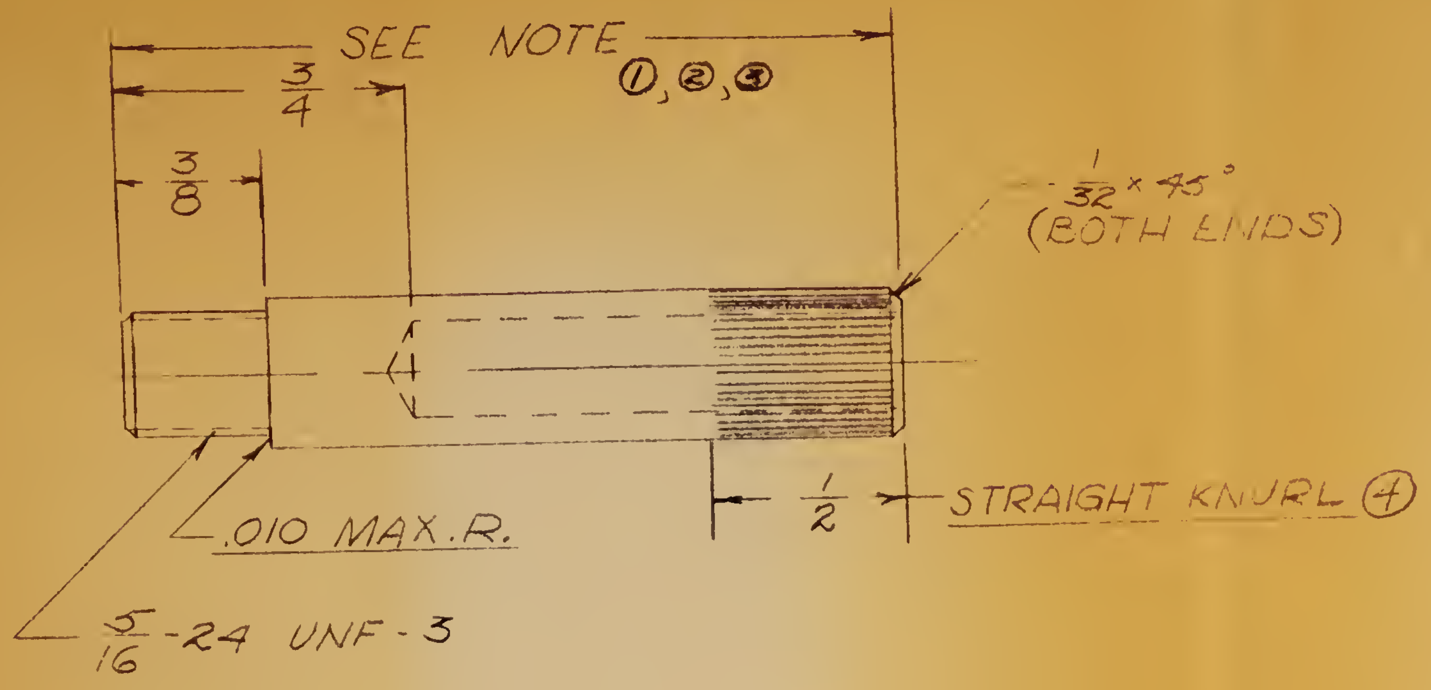
XTENSION, TIP

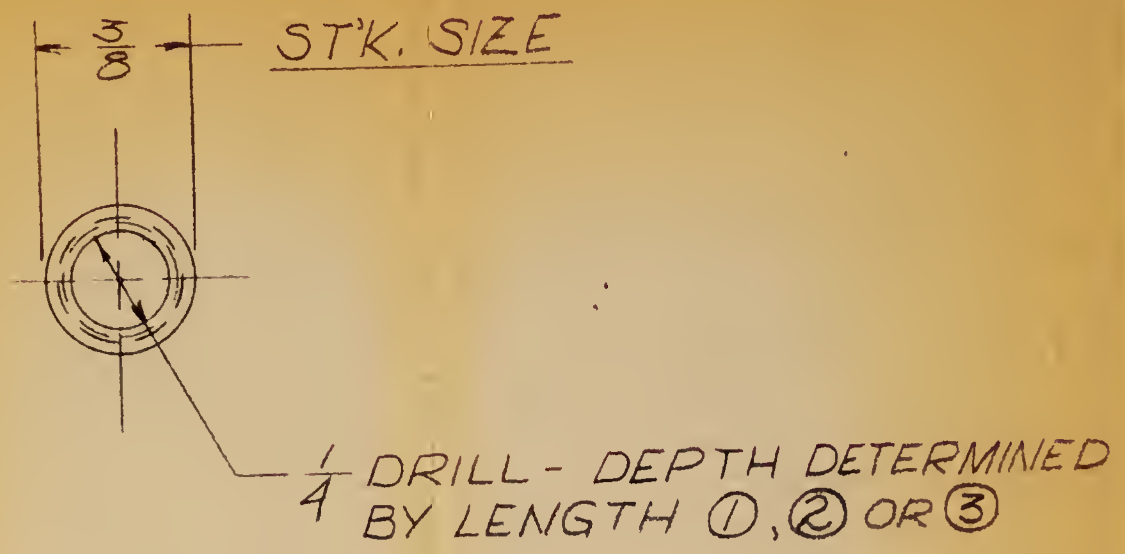
ER		DESIGNED	DRAWN	CHECKED	APPROVED
	NAME	SB	SB	WK	
LY	DATE	30 Oct 6?			

XT ASSEMBLY NO.

PROJECT DRAWING NO.
K6120 -B- 003
004
005

-B-





NOTE: THIS PART REPRESENTED BY 3 DRW'G. NOS.:
① K6120-B-003 = 2 IN.
② K6120-B-004 = 4 IN.
③ K6120-B-005 6 IN.
BRIGHT RED ANODIZE

SYM.	DATE	DESCRIPTION OF REVISION	NAME
④	4 Nov. 68	STRAIGHT KNURL	SB.

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TECHNOLOGY CENTER
CHICAGO, ILLINOIS 60616

MATERIAL ALUM 2024-T4
HEAT TREAT

EXTENSION, TIP

TOLERANCES
UNLESS OTHERWISE SPECIFIED
FRACTIONS ± 1/64 DECIMALS ± .005
THDS CLASS 2 FIT ANGULAR ± 1°

DO NOT SCALE - REPORT ERRORS
BREAK ALL SHARP CORNERS
C'SINK ALL TAPPED HOLES 1/32 x 45°
REMOVE BURRS

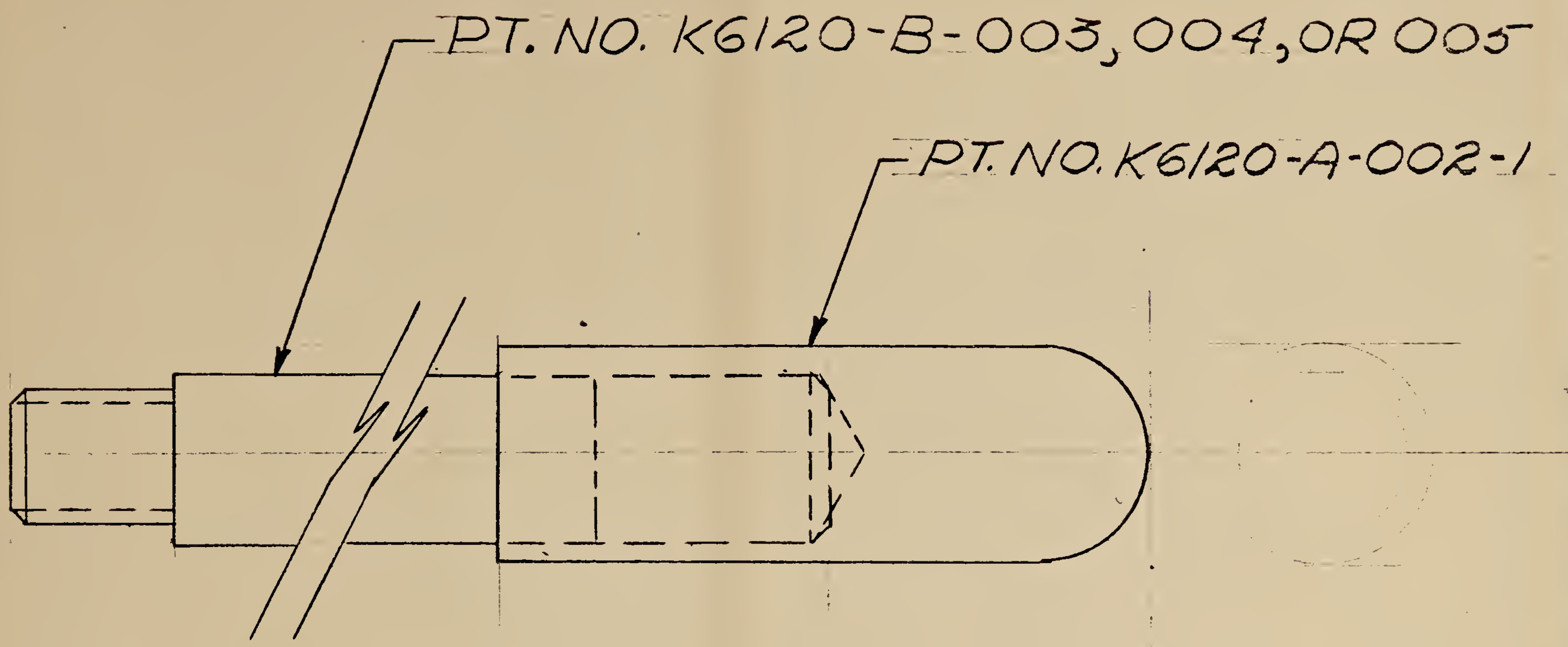
FINISH Stock √ UNLESS OTHERWISE NOTED

QUANTITY PER
SUB-ASSEMBLY

	DESIGNED	DRAWN	CHECKED	APPROVED
NAME	SB	SB	WK	
DATE	20 Oct 68			

SCALE 2:1
NEXT ASSEMBLY NO.
PROJECT DRAWING NO. K6120 -B- 003
004
005

-A-



NOTE: PRESS PARTS TOGETHER AS SHOWN

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SYM.	DATE	DESCRIPTION OF REVISION	NAME

IIT RESEARCH INSTITUTE
TECHNOLOGY CENTER
CHICAGO, ILLINOIS 60616

MATERIAL

HEAT TREAT

ASSEMBLY, TIP & EXTENSION

TOLERANCES
UNLESS OTHERWISE SPECIFIED
FRACTIONS ± 1/64 DECIMALS ± .005
THDS CLASS 2 FIT ANGULAR ± 1°

DO NOT SCALE - REPORT ERRORS
BREAK ALL SHARP CORNERS
C'SINK ALL TAPPED HOLES 1/32 x 45°
REMOVE BURRS

FINISH
∇
UNLESS OTHERWISE NOTED

QUANTITY PER

SUB-ASSEMBLY

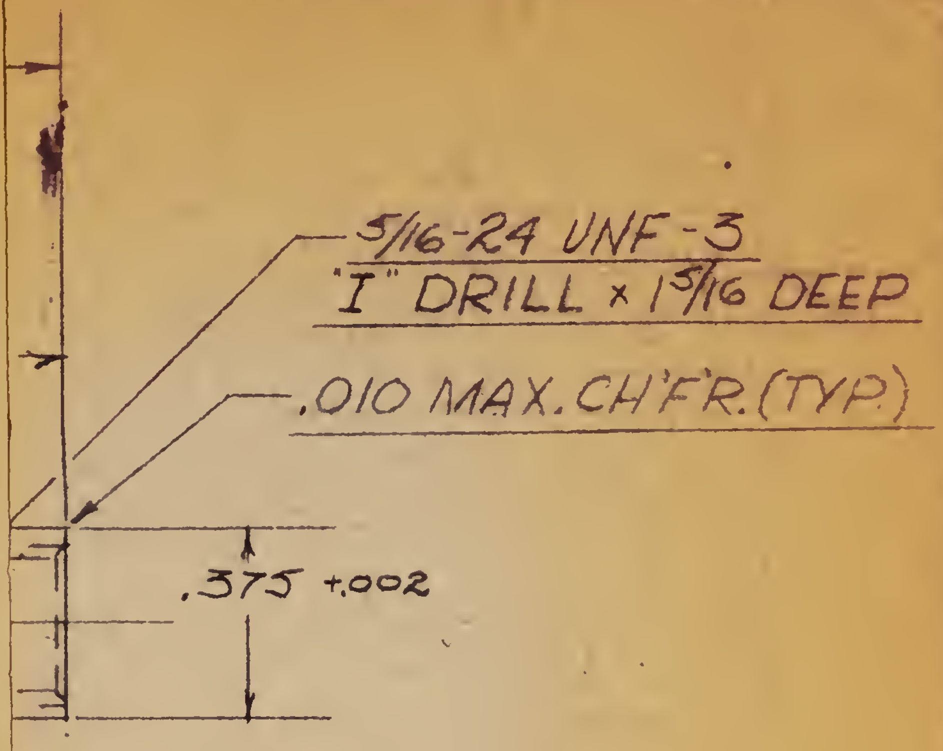
	DESIGNED	DRAWN	CHECKED	APPROVED
NAME	A-B	S.B.		
DATE		4NOV68		

SCALE: 2:1

NEXT ASSEMBLY NO.

PROJECT DRAWING NO.: K6120 -A- 006

-B-



NOTE: BRIGHT

DESCRIPTION OF REVISION	NAME

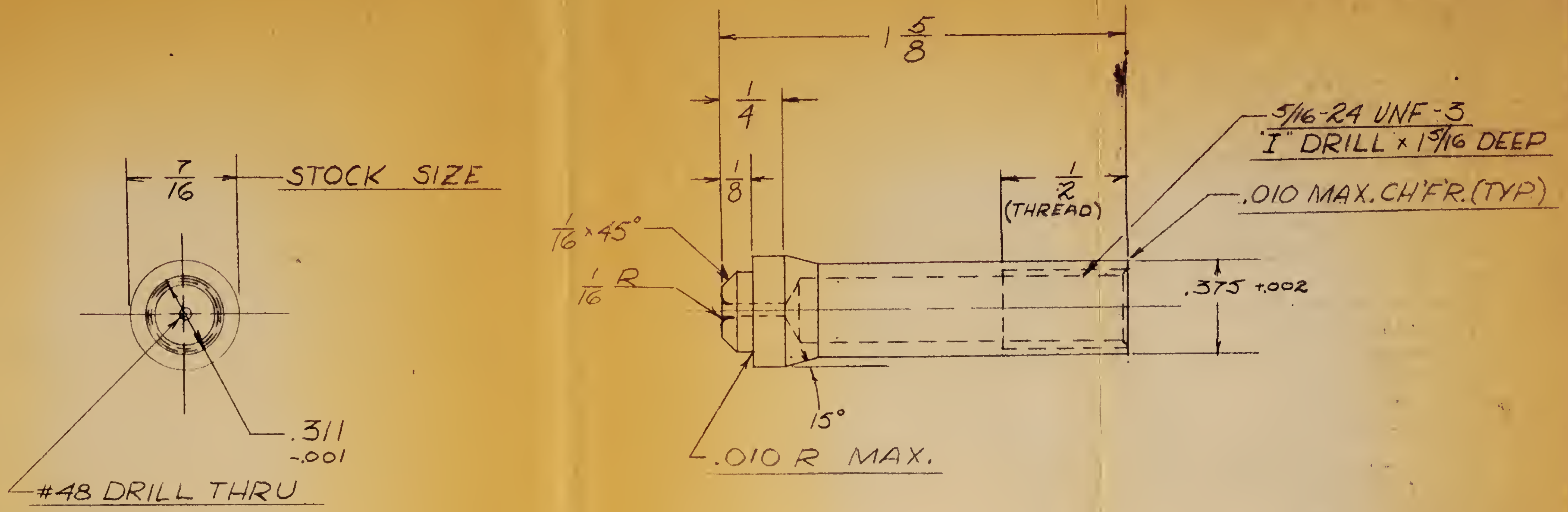
RESEARCH INSTITUTE
CENTER CHICAGO, ILLINOIS 60616

GMENT, TIP

R		DESIGNED	DRAWN	CHECKED	APPROVED
	NAME	SB	SB	WK	
LY	DATE	6/6/67	9/29/67		

T ASSEMBLY NO.	PROJECT DRAWING NO.
	K6120-B-007

-B-



NOTE: BRIGHT RED ANODIZE

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SYM.	DATE	DESCRIPTION OF REVISION	NAME

IIT RESEARCH INSTITUTE
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MATERIAL
ALUM. 2024-T3
HEAT TREAT

SEGMENT, TIP

TOLERANCES
UNLESS OTHERWISE SPECIFIED
FRACTIONS ± 1/64 DECIMALS ± .005
THDS CLASS 2 FIT ANGULAR ± 1°

DO NOT SCALE - REPORT ERRORS
BREAK ALL SHARP CORNERS
C'SINK ALL TAPPED HOLES 1/32 x 45°
REMOVE BURRS

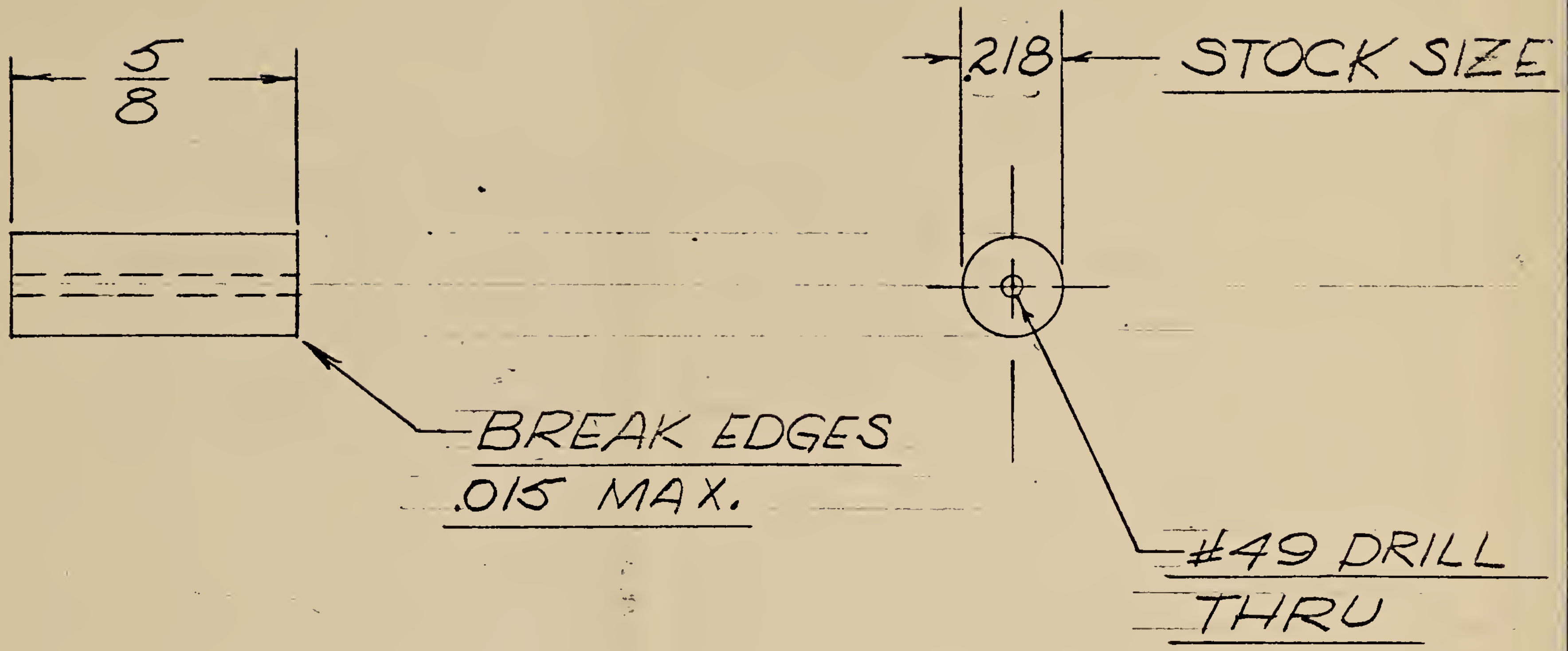
FINISH
64
UNLESS OTHERWISE NOTED

QUANTITY PER
1
SUB-ASSEMBLY

	DESIGNED	DRAWN	CHECKED	APPROVED
NAME	SB	SB	WK	
DATE	6/6/67	9/29/67		

SCALE	NEXT ASSEMBLY NO.	PROJECT DRAWING NO.
2:1		K6120-B-007

-A-



SYM.	DATE	DESCRIPTION OF REVISION	NAME

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IIT RESEARCH INSTITUTE
TECHNOLOGY CENTER
CHICAGO, ILLINOIS 60616

MATERIAL 1020 STEEL, C.R.
HEAT TREAT .218 NOM. SIZE

FITTING, SWAGE

TOLERANCES
UNLESS OTHERWISE SPECIFIED
FRACTIONS ± 1/64 DECIMALS ± .005
THDS CLASS 2 FIT ANGULAR ± 1°

DO NOT SCALE - REPORT ERRORS
BREAK ALL SHARP CORNERS
C'SINK ALL TAPPED HOLES 1/32 x 45°
REMOVE BURRS

FINISH 64 UNLESS OTHERWISE NOTED

QUANTITY PER
SUB-ASSEMBLY

	DESIGNED	DRAWN	CHECKED	APPROVED
NAME	SB	SB	WK	
DATE				

SCALE 2:1

NEXT ASSEMBLY NO.

PROJECT DRAWING NO. K6120-A-008

-A-

1/16 x 38. 1/4 long

7 x 7D PREF. STAINLESS STEEL A/C

EXERCISE CARE IN CUTTING TO LENGTH SO THAT ENDS

DO NOT UNRAVEL

TIN (SOFT SOLDER) ONE END FOR 1/8"

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SYM.	DATE	DESCRIPTION OF REVISION	NAME

IIT RESEARCH INSTITUTE
TECHNOLOGY CENTER CHICAGO, ILLINOIS 60616

MATERIAL

HEAT TREAT

CABLE

TOLERANCES
UNLESS OTHERWISE SPECIFIED
FRACTIONS ± 1/64 DECIMALS ± .005
THDS CLASS 2 FIT ANGULAR ± 1°

DO NOT SCALE - REPORT ERRORS
BREAK ALL SHARP CORNERS
C'SINK ALL TAPPED HOLES 1/32 x 45°
REMOVE BURRS

FINISH
√
UNLESS OTHERWISE NOTED

QUANTITY PER

SUB-ASSEMBLY

	DESIGNED	DRAWN	CHECKED	APPROVED
NAME	AB	FB.	WK	
DATE				

SCALE

NEXT ASSEMBLY NO.

PROJECT DRAWING NO.
K6120 -A-009

K6120-A-010

RIVET
AMERICAN STANDARD SMALL SOLID RIVET
3/32 NOMINAL DIA, 3/8 LONG

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SYM.	DATE	DESCRIPTION OF REVISION	NAME

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TECHNOLOGY CENTER CHICAGO, ILLINOIS 60616

MATERIAL
STAINLESS STEEL
HEAT TREAT

RIVET

TOLERANCES
UNLESS OTHERWISE SPECIFIED
FRACTIONS ± 1/64 DECIMALS ± .005
THDS CLASS 2 FIT ANGULAR ± 1°

DO NOT SCALE - REPORT ERRORS
BREAK ALL SHARP CORNERS
C'SINK ALL TAPPED HOLES 1/32 x 45°
REMOVE BURRS

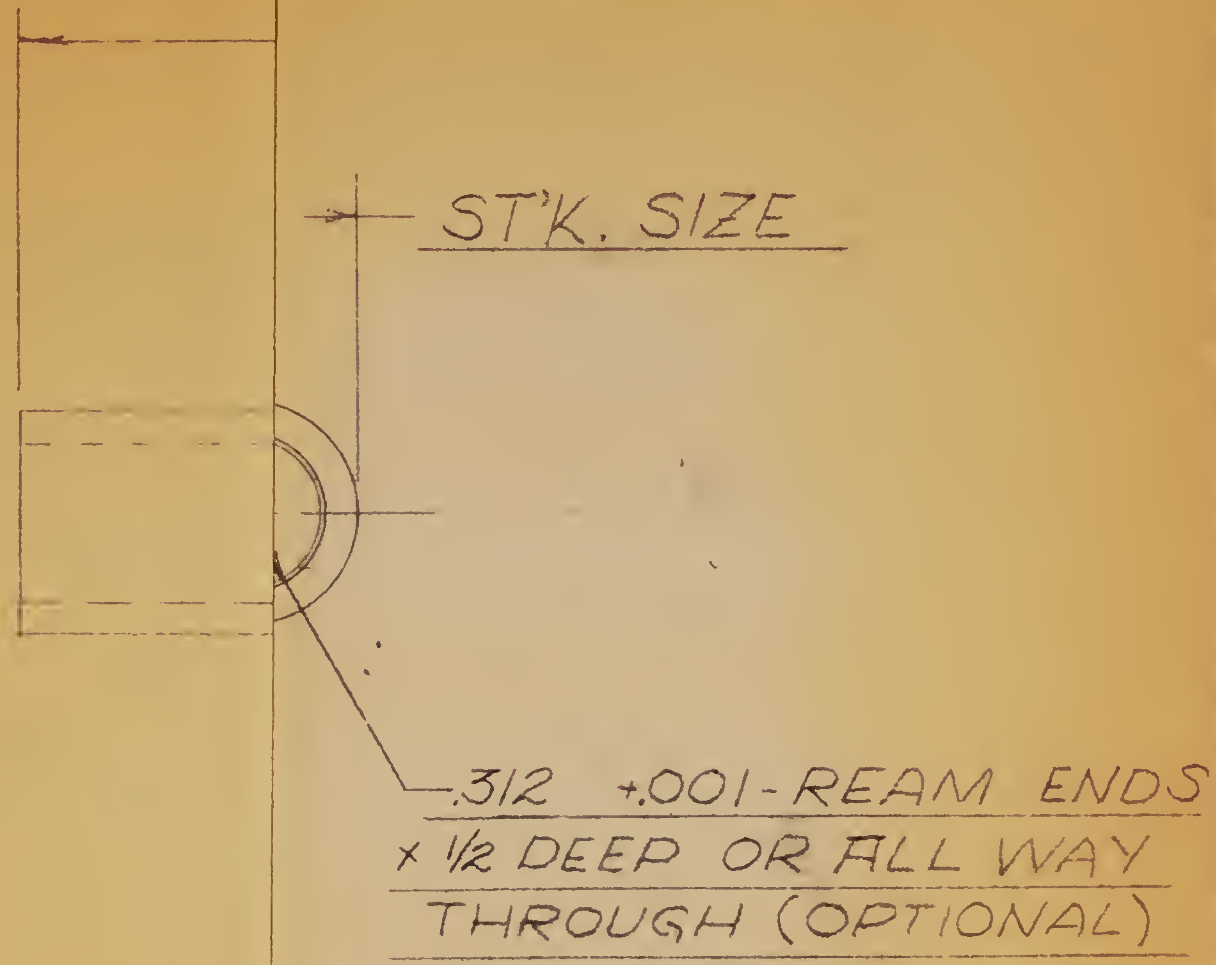
FINISH
√
UNLESS OTHERWISE NOTED

QUANTITY PER
1
SUB-ASSEMBLY

	DESIGNED	DRAWN	CHECKED	APPROVED
NAME		Rp		
DATE		1/24/68		

SCALE	NEXT ASSEMBLY NO.	PROJECT DRAWING NO.
—		K6120-A-010

-B-



NOTE: WHITE ANOD

BRIGHT RED ANOD

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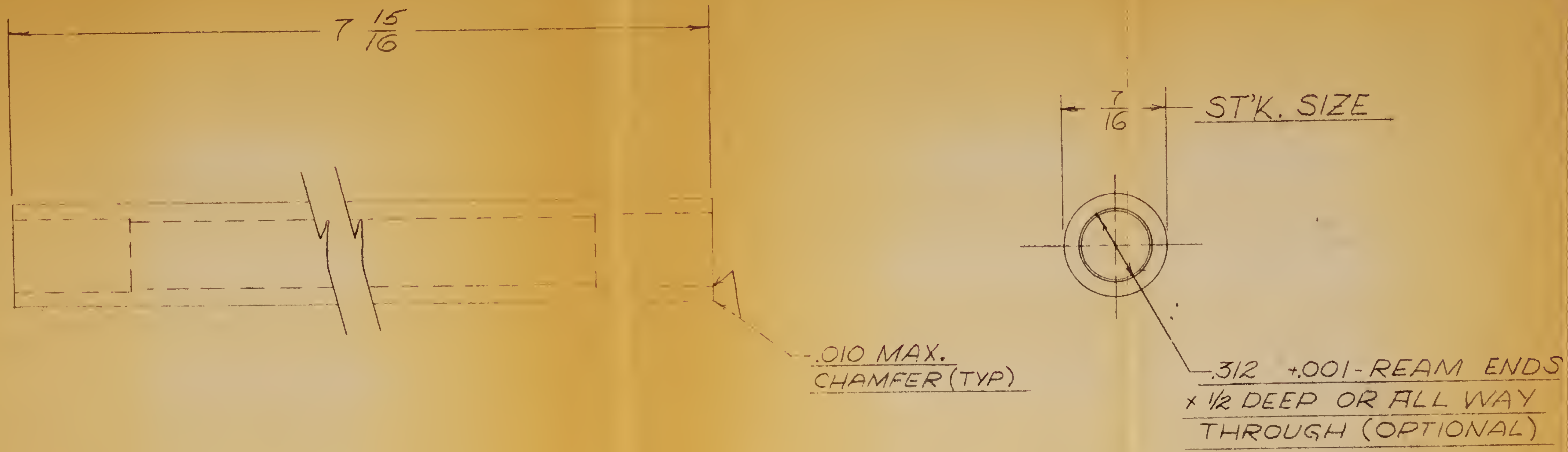
SEGMENT, LONG

ER		DESIGNED	DRAWN	CHECKED	APPROVED
	NAME	SB	SB	WK	
LY	DATE				

XT ASSEMBLY NO.	PROJECT DRAWING NO.
	K6120-B-011

-B-


7 15/16
7/16
ST'K. SIZE
.010 MAX. CHAMFER (TYP)
.312 +.001 - REAM ENDS x 1/2 DEEP OR ALL WAY THROUGH (OPTIONAL)

NOTE: WHITE ANODIZE 2 OF EACH CANE
BRIGHT RED ANODIZE 1 OF EACH CANE

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SYM.	DATE	DESCRIPTION OF REVISION	NAME

IIT RESEARCH INSTITUTE
TECHNOLOGY CENTER CHICAGO, ILLINOIS 60616

MATERIAL 6061-T6 ALUM. TUBING - 7/16 x.065 WALL
HEAT TREAT

SEGMENT, LONG

TOLERANCES
UNLESS OTHERWISE SPECIFIED
FRACTIONS ± 1/64 DECIMALS ± .005
THDS CLASS 2 FIT ANGULAR ± 1°

DO NOT SCALE - REPORT ERRORS
BREAK ALL SHARP CORNERS
C'SINK ALL TAPPED HOLES 1/32 x 45°
REMOVE BURRS

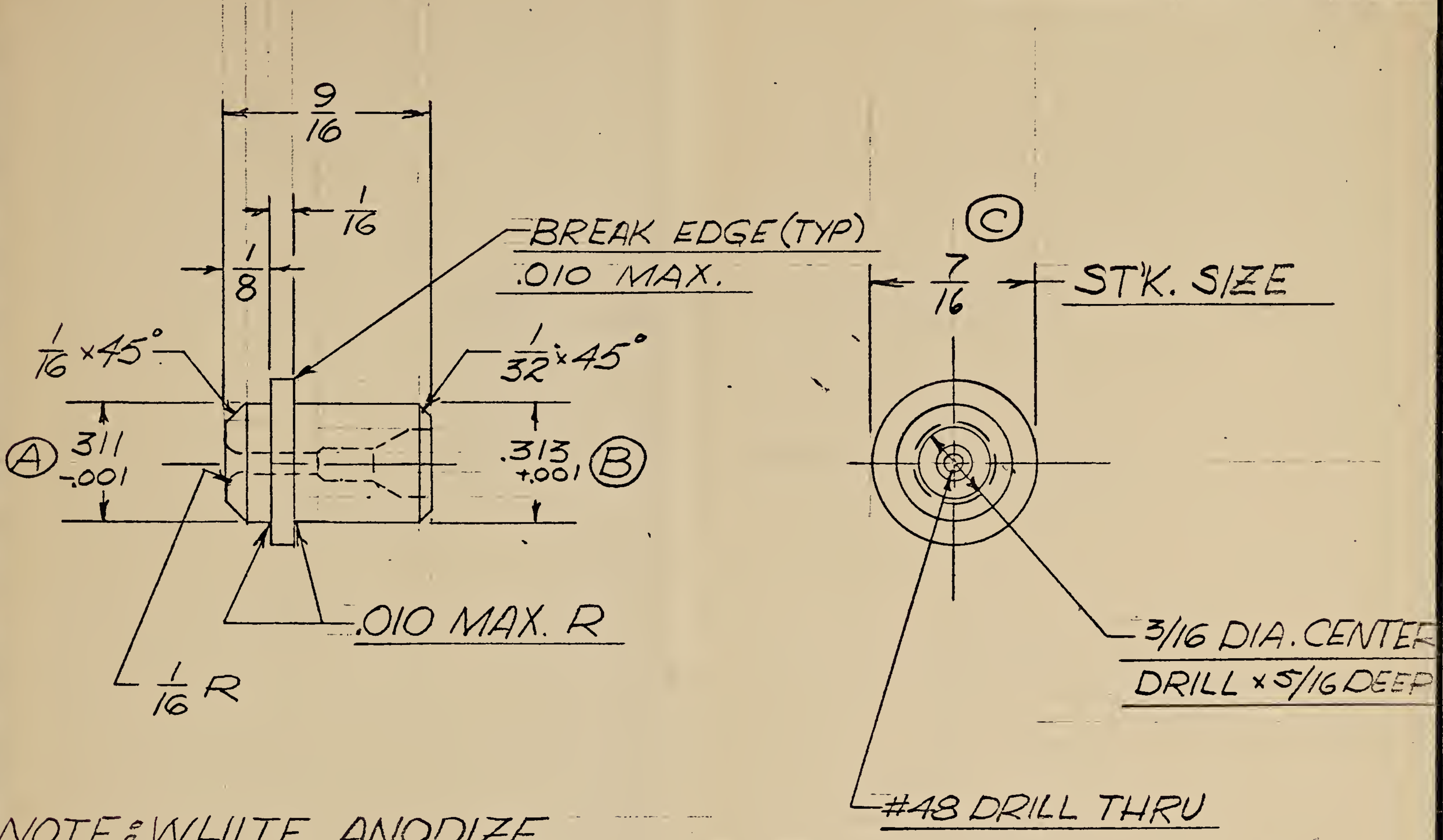
FINISH 64 UNLESS OTHERWISE NOTED

QUANTITY PER
SUB-ASSEMBLY

	DESIGNED	DRAWN	CHECKED	APPROVED
NAME	SB	SB	WK	
DATE				

SCALE 2:1
NEXT ASSEMBLY NO.
PROJECT DRAWING NO. K6120-B-011

-A-



NOTE: WHITE ANODIZE
DIA'S. A, B, C, & #48 HOLE
⊙ WITHIN .003 TIR

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SYM.	DATE	DESCRIPTION OF REVISION	NAME

IIT RESEARCH INSTITUTE
TECHNOLOGY CENTER CHICAGO, ILLINOIS 60616

MATERIAL
ALUM. 2024-T4

HEAT TREAT

INSERT

TOLERANCES
UNLESS OTHERWISE SPECIFIED
FRACTIONS ± 1/64 DECIMALS ± .005
THDS CLASS 2 FIT ANGULAR ± 1°

DO NOT SCALE - REPORT ERRORS
BREAK ALL SHARP CORNERS
C'SINK ALL TAPPED HOLES 1/32 x 45°
REMOVE BURRS

FINISH
64 √
UNLESS OTHERWISE NOTED

QUANTITY PER
3 SUB-ASSEMBLY

	DESIGNED	DRAWN	CHECKED	APPROVED
NAME	GB	GB.	WK	
DATE				

SCALE
2:1

NEXT ASSEMBLY NO.

PROJECT DRAWING NO.
K6120-A-012

K6120 -A- 013

PRESS INSERT; PT. NO.K6120-A-012
INTO LONG SEGMENT, PT. NO.
K6120-B-011, ONE END ONLY; AS
SHOWN IN DRW'G.J6048-R-001

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SYM.	DATE	DESCRIPTION OF REVISION	NAME

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TECHNOLOGY CENTER CHICAGO, ILLINOIS 60616

MATERIAL

HEAT TREAT

INSERT / SEGMENT ASSEMBLY

TOLERANCES
UNLESS OTHERWISE SPECIFIED
FRACTIONS ± 1/64 DECIMALS ± .005
THDS CLASS 2 FIT ANGULAR ± 1°

DO NOT SCALE - REPORT ERRORS
BREAK ALL SHARP CORNERS
C'SINK ALL TAPPED HOLES 1/32 x 45°
REMOVE BURRS

FINISH
√
UNLESS OTHERWISE NOTED

QUANTITY PER

SUB-ASSEMBLY

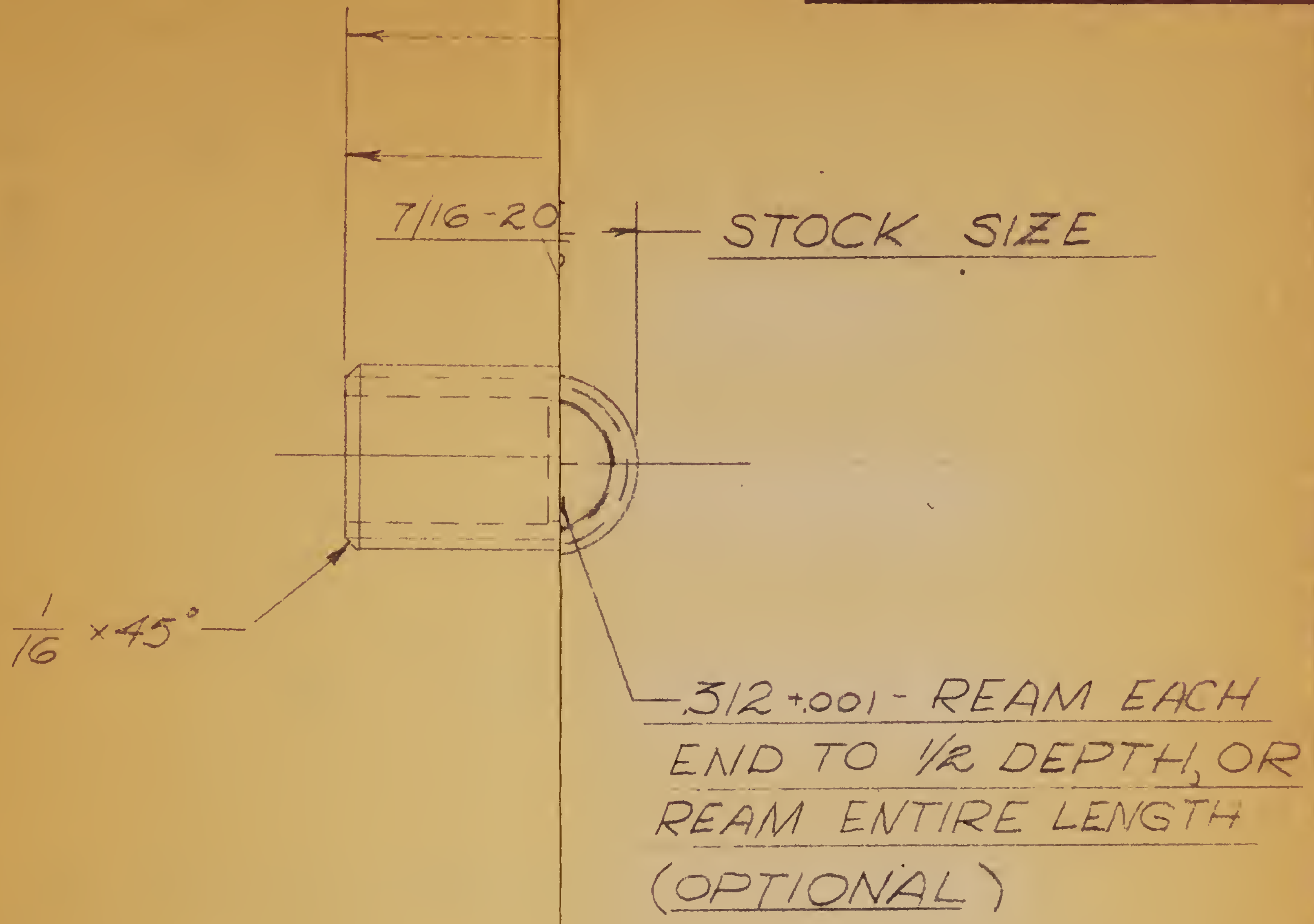
	DESIGNED	DRAWN	CHECKED	APPROVED
NAME		SB		
DATE		2/21/68		

SCALE

NEXT ASSEMBLY NO.

PROJECT DRAWING NO.
K6120-A-013

-B-


7/16-20
STOCK SIZE
1/16 × 45°
.312 +.001 - REAM EACH END TO 1/2 DEPTH, OR REAM ENTIRE LENGTH (OPTIONAL)

NOTE: WHITE ANODI

DESCRIPTION OF REVISION	NAME

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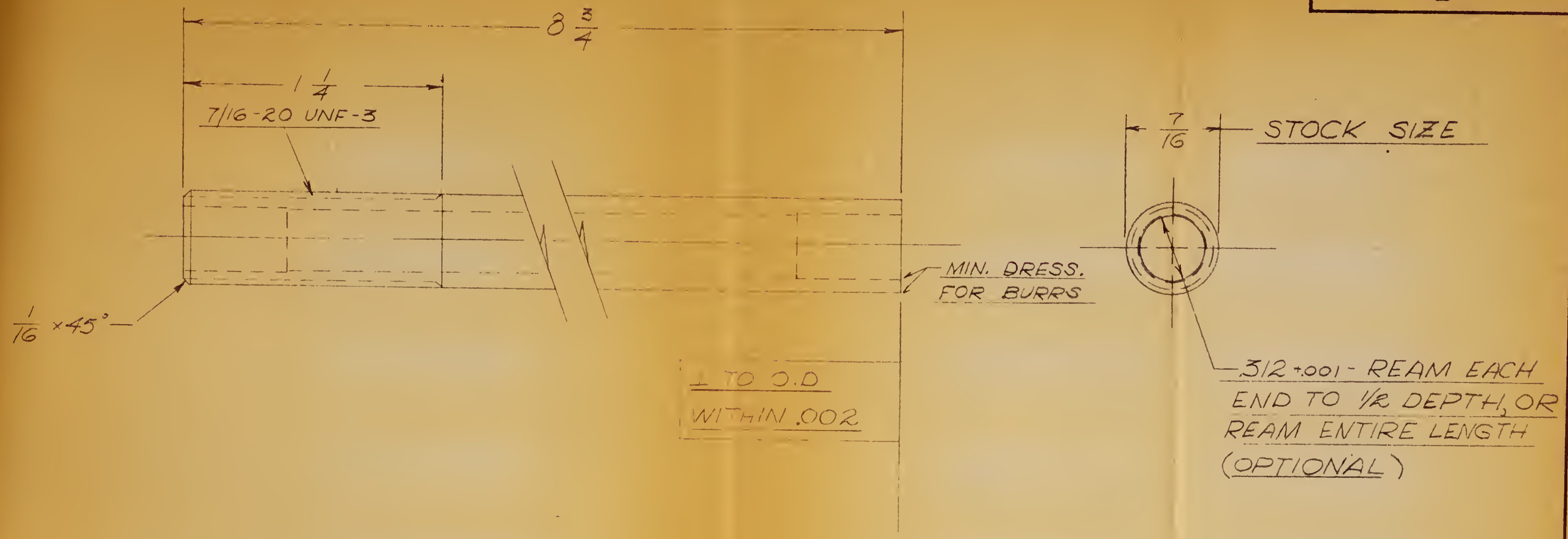
SEGMENT, TOP

R		DESIGNED	DRAWN	CHECKED	APPROVED
	NAME	SB	SB	WK	
LY	DATE				

XT ASSEMBLY NO.	PROJECT DRAWING NO.
	K6120-B-014

-B-



NOTE: WHITE ANODIZE

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SYM.	DATE	DESCRIPTION OF REVISION	NAME

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TECHNOLOGY CENTER **CHICAGO, ILLINOIS 60616**

MATERIAL ALUM. SEAMLESS TUBE 7/16 × .065 WALL - 6061-T3

HEAT TREAT

SEGMENT, TOP

TOLERANCES
UNLESS OTHERWISE SPECIFIED
FRACTIONS ± 1/64 DECIMALS ± .005
THDS CLASS 2 FIT ANGULAR ± 1°

DO NOT SCALE - REPORT ERRORS
BREAK ALL SHARP CORNERS
C'SINK ALL TAPPED HOLES 1/32 x 45°
REMOVE BURRS

FINISH 64 √ UNLESS OTHERWISE NOTED

QUANTITY PER SUB-ASSEMBLY

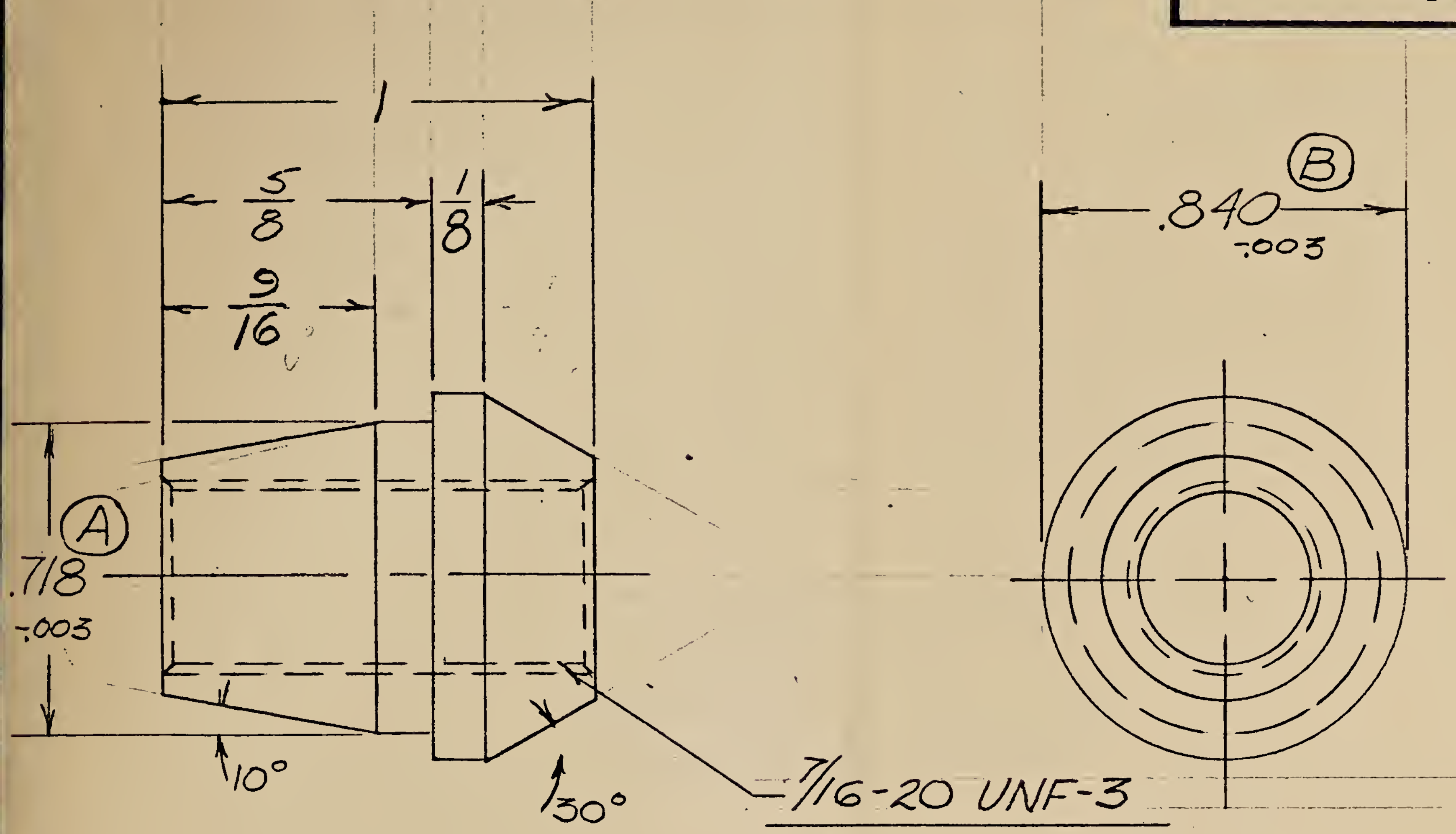
	DESIGNED	DRAWN	CHECKED	APPROVED
NAME	SB	SB	WK	
DATE				

SCALE 2:1

NEXT ASSEMBLY NO.

PROJECT DRAWING NO. K6120-B-014

-A-



NOTE: DIA. A, B, & THR'D. ⊙ WITHIN .005 TIR

WHITE ANODIZE

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SYM.	DATE	DESCRIPTION OF REVISION	NAME

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MATERIAL ALUM 2024-T6

HEAT TREAT

NUT, ADJUSTMENT

TOLERANCES
UNLESS OTHERWISE SPECIFIED
FRACTIONS ± 1/64 DECIMALS ± .005
THDS CLASS 2 FIT ANGULAR ± 1°

DO NOT SCALE - REPORT ERRORS
BREAK ALL SHARP CORNERS
C'SINK ALL TAPPED HOLES 1/32 x 45°
REMOVE BURRS

FINISH 64√ UNLESS OTHERWISE NOTED

QUANTITY PER 1 SUB-ASSEMBLY

	DESIGNED	DRAWN	CHECKED	APPROVED
NAME	SB	SB	WK	
DATE				

SCALE 2:1

NEXT ASSEMBLY NO.

PROJECT DRAWING NO. K6120-A-017

-A-

SWAGE FITTING, ELBOW -
PURCHASE FROM
COLLAPSABLE PRODUCTS, INC.
MIAMI BEACH, FLORIDA

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SYM.	DATE	DESCRIPTION OF REVISION	NAME

IIT RESEARCH INSTITUTE
TECHNOLOGY CENTER CHICAGO, ILLINOIS 60616

MATERIAL

HEAT TREAT

Swage Fitting, Elbow

TOLERANCES
UNLESS OTHERWISE SPECIFIED
FRACTIONS ± 1/64 DECIMALS ± .005
THDS CLASS 2 FIT ANGULAR ± 1°

DO NOT SCALE - REPORT ERRORS
BREAK ALL SHARP CORNERS
C'SINK ALL TAPPED HOLES 1/32 x 45°
REMOVE BURRS

FINISH
√
UNLESS OTHERWISE NOTED

QUANTITY PER

SUB-ASSEMBLY

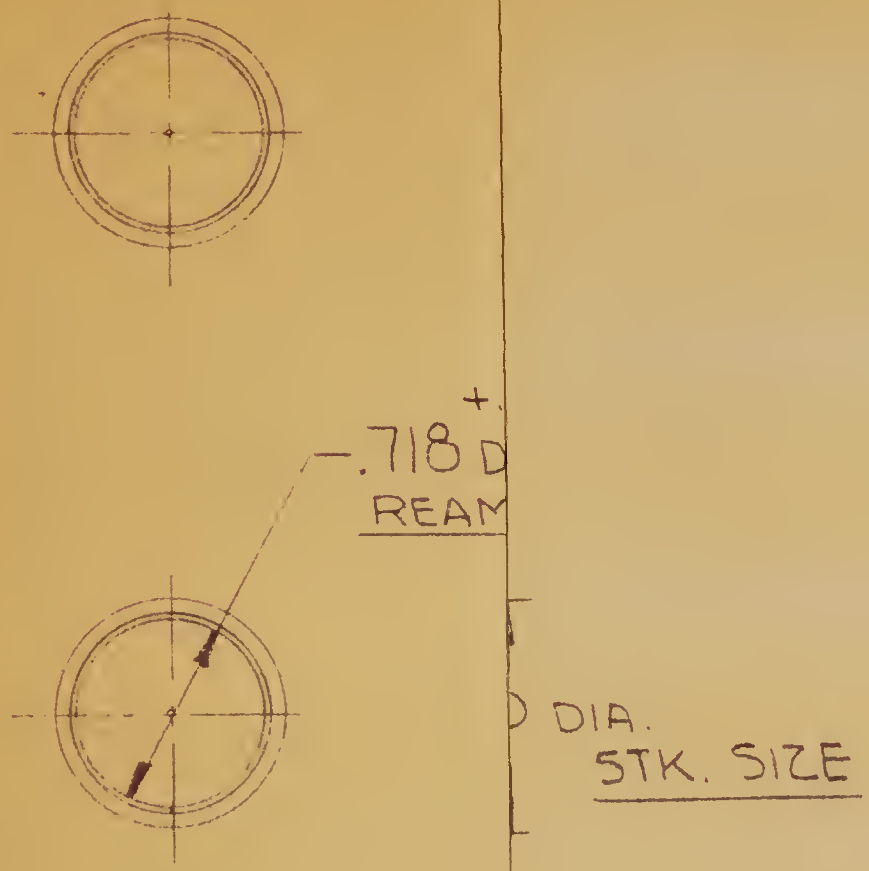
	DESIGNED	DRAWN	CHECKED	APPROVED
NAME				
DATE				

SCALE

NEXT ASSEMBLY NO.

PROJECT DRAWING NO.
K6120 -A- 018

-B-



MAT'L. - ALUM
.840 O

DESCRIPTION OF REVISION	NAME

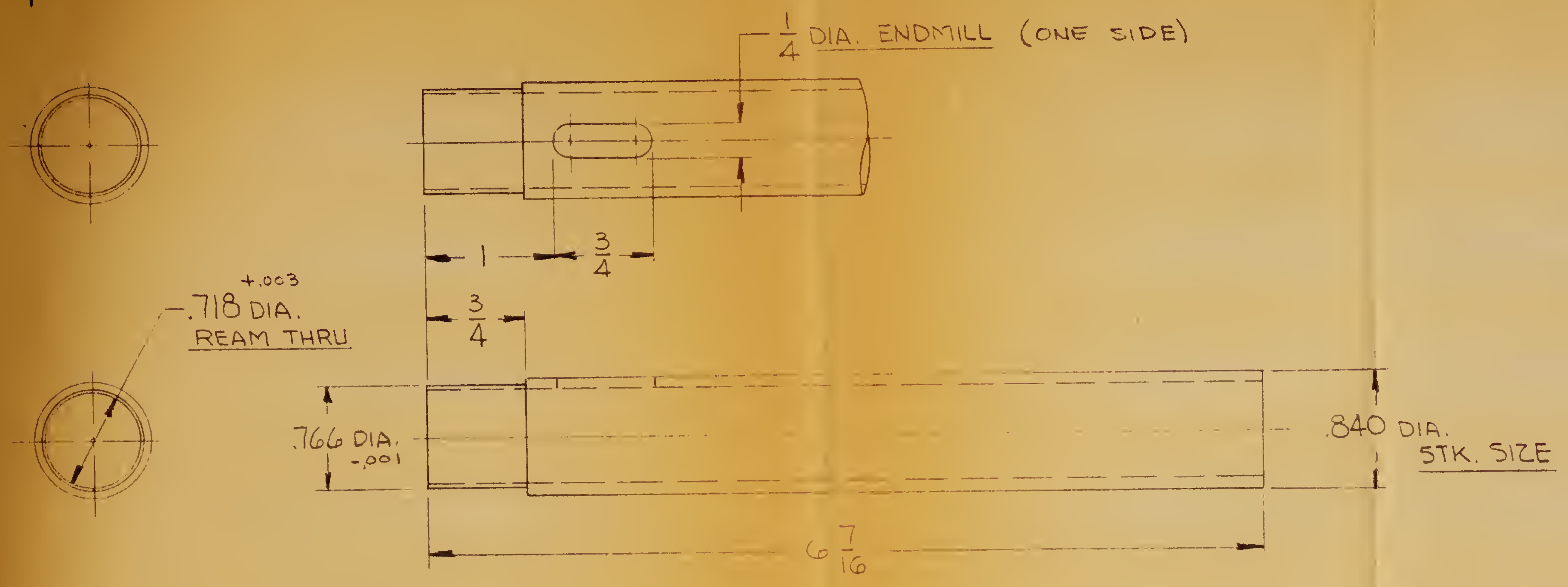
RESEARCH INSTITUTE
CENTER CHICAGO, ILLINOIS 60616

ANDLE

ER		DESIGNED	DRAWN	CHECKED	APPROVED
	NAME		WER	WK	
BLY	DATE		9-29-67		

EXT ASSEMBLY NO.	PROJECT DRAWING NO.
	K6120-B-019

-B-



MAT'L. - ALUM 6061 T6 OR EQUIV.
.840 O.D. x .622 I.D.

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SYM.	DATE	DESCRIPTION OF REVISION	NAME

IIT RESEARCH INSTITUTE
TECHNOLOGY CENTER CHICAGO, ILLINOIS 60616

MATERIAL SEE NOTE

HEAT TREAT NONE

HANDLE

TOLERANCES
UNLESS OTHERWISE SPECIFIED
FRACTIONS ± 1/64 DECIMALS ± .005
THDS CLASS 2 FIT ANGULAR ± 1°

DO NOT SCALE - REPORT ERRORS
BREAK ALL SHARP CORNERS
C'SINK ALL TAPPED HOLES 1/32 x 45°
REMOVE BURRS

FINISH √ UNLESS OTHERWISE NOTED

QUANTITY PER 1 SUB-ASSEMBLY

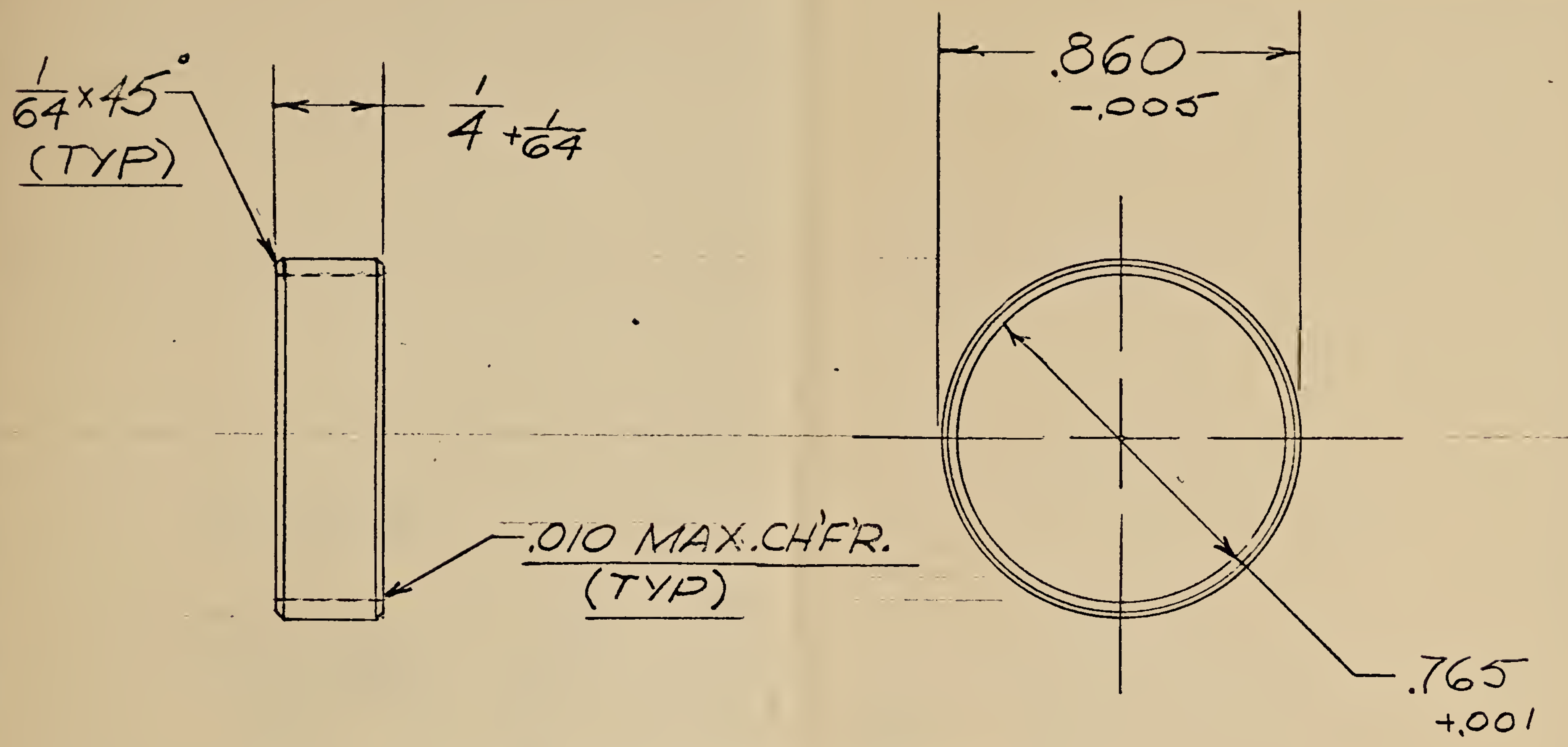
	DESIGNED	DRAWN	CHECKED	APPROVED
NAME		WER	WK	
DATE		9-29-67		

SCALE 1-1

NEXT ASSEMBLY NO.

PROJECT DRAWING NO. K6120-B-019

-A-



NOTE: GRINDING NOT NECESSARY AFTER HARDENING.
REMOVE SCALE ONLY (IF PRESENT)

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SYM.	DATE	DESCRIPTION OF REVISION	NAME

IIT RESEARCH INSTITUTE
TECHNOLOGY CENTER CHICAGO, ILLINOIS 60616

MATERIAL
DRILL ROD

HEAT TREAT
50-53 Rc

RING, WEAR

TOLERANCES
UNLESS OTHERWISE SPECIFIED
FRACTIONS ± 1/64 DECIMALS ± .005
THDS CLASS 2 FIT ANGULAR ± 1°

DO NOT SCALE - REPORT ERRORS
BREAK ALL SHARP CORNERS
C'SINK ALL TAPPED HOLES 1/32 x 45°
REMOVE BURRS

FINISH
64
UNLESS OTHERWISE NOTED

QUANTITY PER
1 SUB-ASSEMBLY

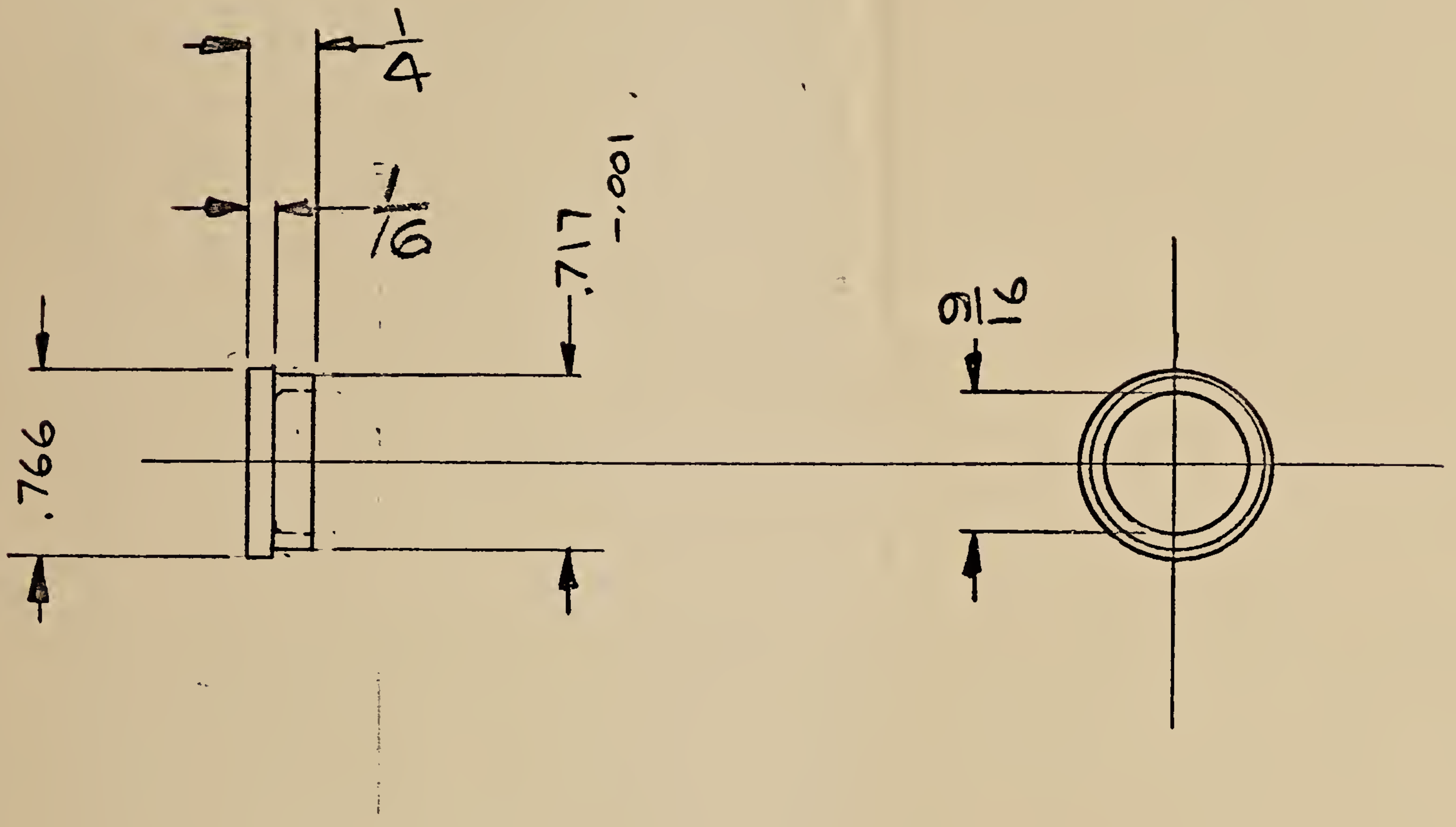
	DESIGNED	DRAWN	CHECKED	APPROVED
NAME	SB	SB	W.K.	
DATE		9/29/67		

SCALE
2:1

NEXT ASSEMBLY NO.

PROJECT DRAWING NO.
K6120-A-020

K-6120-A-021



SYM.	DATE	DESCRIPTION OF REVISION	NAME

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IIT RESEARCH INSTITUTE
TECHNOLOGY CENTER CHICAGO, ILLINOIS 60616

MATERIAL 6061-T6 ALUM
HEAT TREAT

CAP

TOLERANCES
UNLESS OTHERWISE SPECIFIED
FRACTIONS ± 1/64 DECIMALS ± .005
THDS CLASS 2 FIT ANGULAR ± 1°

DO NOT SCALE - REPORT ERRORS
BREAK ALL SHARP CORNERS
C'SINK ALL TAPPED HOLES 1/32 x 45°
REMOVE BURRS

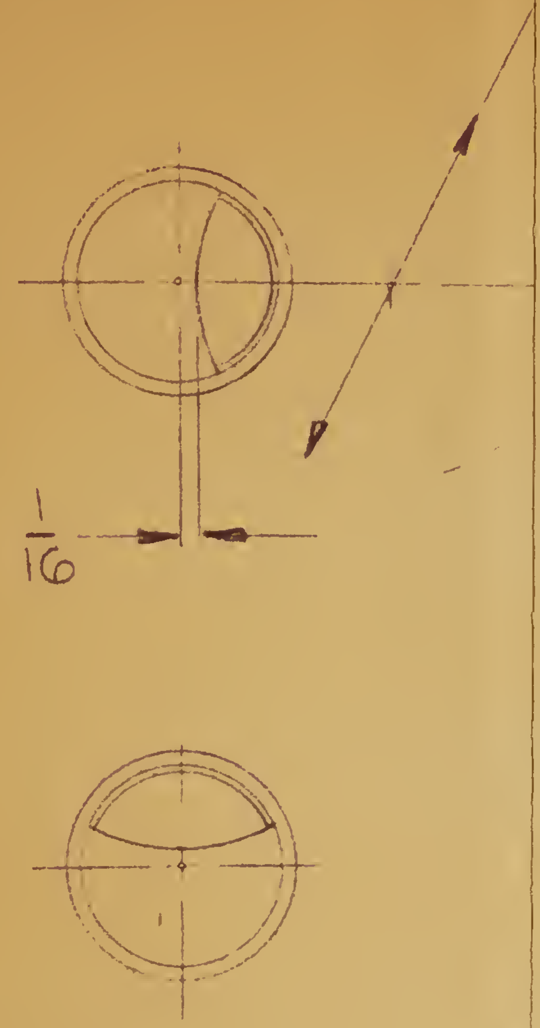
FINISH 64 ▽ UNLESS OTHERWISE NOTED

QUANTITY PER
SUB-ASSEMBLY

	DESIGNED	DRAWN	CHECKED	APPROVED
NAME	AB	WK	AB	
DATE		12-1-67		

SCALE 1:1
NEXT ASSEMBLY NO.
PROJECT DRAWING NO. K-6120-A-021

-B-



NOTE - ASSEMBLE
EPOXY SUCH AS "
OR EQUIV. CURE

DESCRIPTION OF REVISION	NAME

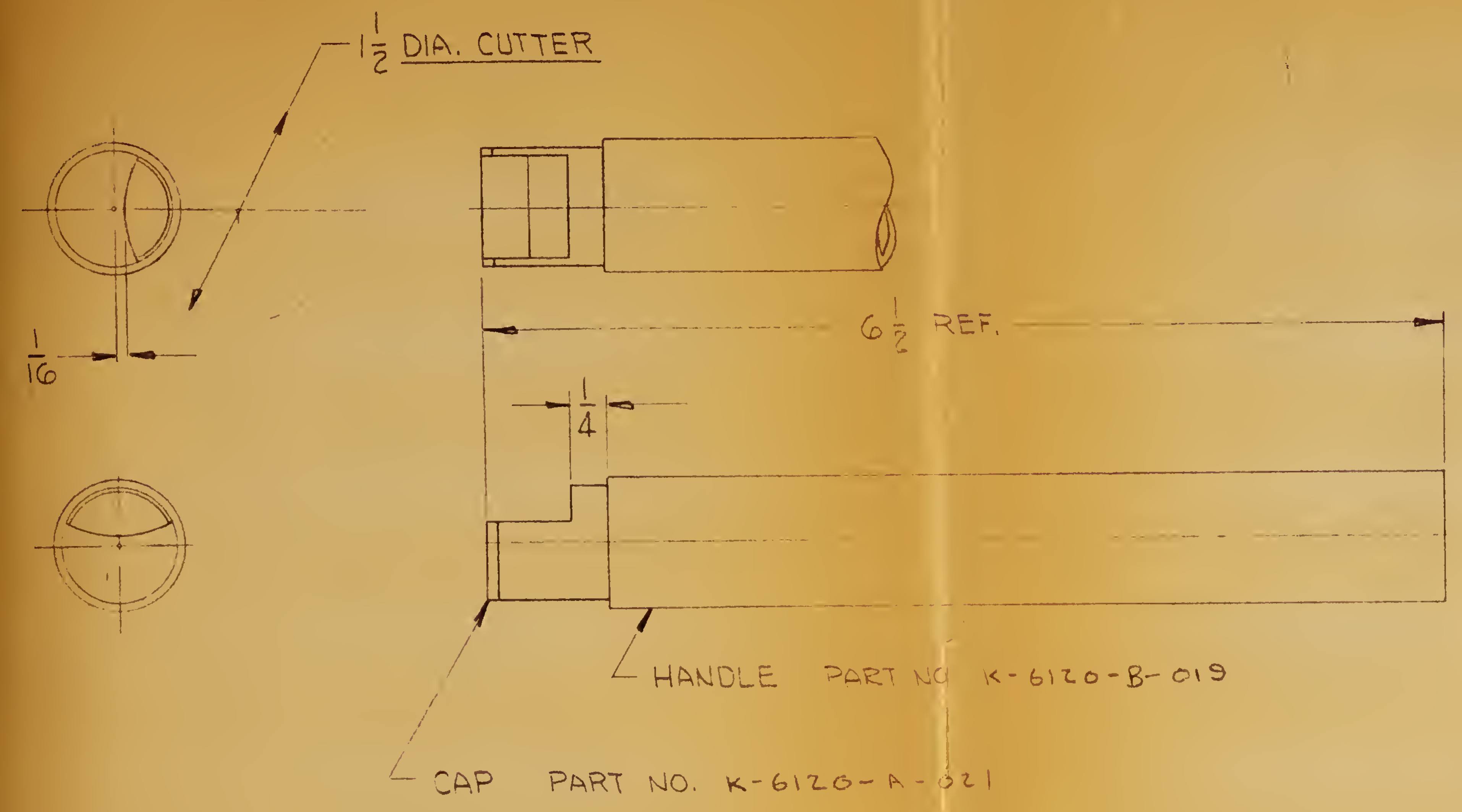
RESEARCH INSTITUTE
CENTER CHICAGO, ILLINOIS 60616

LE & CAP ASSEM.

R		DESIGNED	DRAWN	CHECKED	APPROVED
	NAME	SB	WER	WK	
LY	DATE				

XT ASSEMBLY NO.	PROJECT DRAWING NO.
	K6120-B-022

-B-



NOTE - ASSEMBLE HANDLE & CAP WITH EPOXY SUCH AS "HYSOL EPOXI" (HYSOL CORP) OR EQUIV. CURE THOURGHLY BEFORE MACHINING.

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SYM.	DATE	DESCRIPTION OF REVISION	NAME

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TECHNOLOGY CENTER
CHICAGO, ILLINOIS 60616

MATERIAL N/A
HEAT TREAT

HANDLE & CAP ASSEM.

TOLERANCES
UNLESS OTHERWISE SPECIFIED
FRACTIONS ± 1/64 DECIMALS ± .005
THDS CLASS 2 FIT ANGULAR ± 1°

DO NOT SCALE - REPORT ERRORS
BREAK ALL SHARP CORNERS
C'SINK ALL TAPPED HOLES 1/32 x 45°
REMOVE BURRS

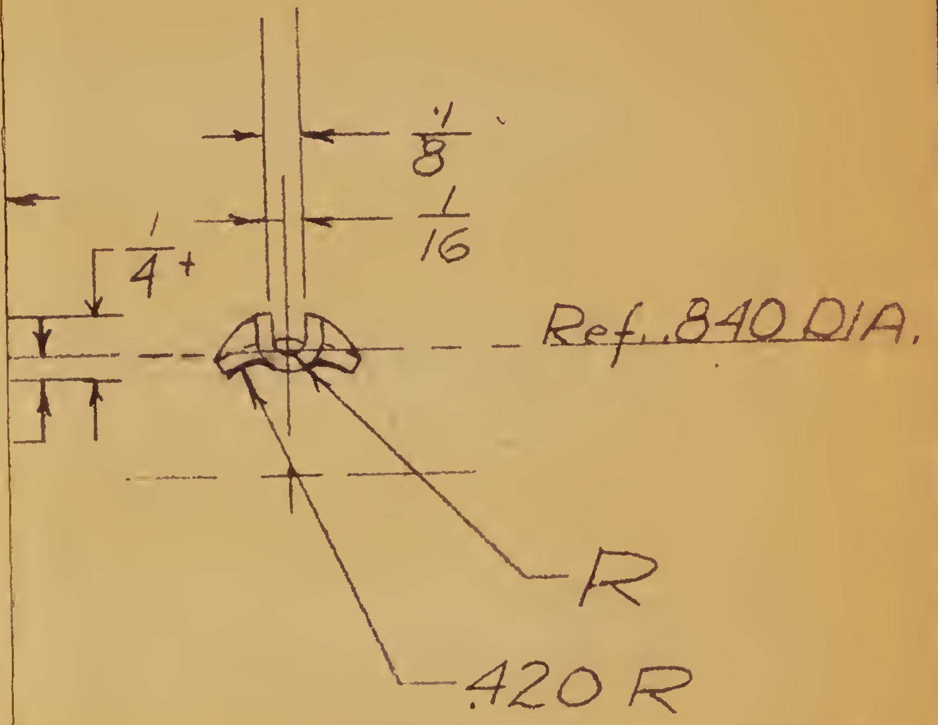
FINISH √ UNLESS OTHERWISE NOTED

QUANTITY PER
SUB-ASSEMBLY

	DESIGNED	DRAWN	CHECKED	APPROVED
NAME	SB	WER	WK	
DATE				

SCALE	NEXT ASSEMBLY NO.	PROJECT DRAWING NO.
1-1		K6120-B-022

-B-



DESCRIPTION OF REVISION	NAME

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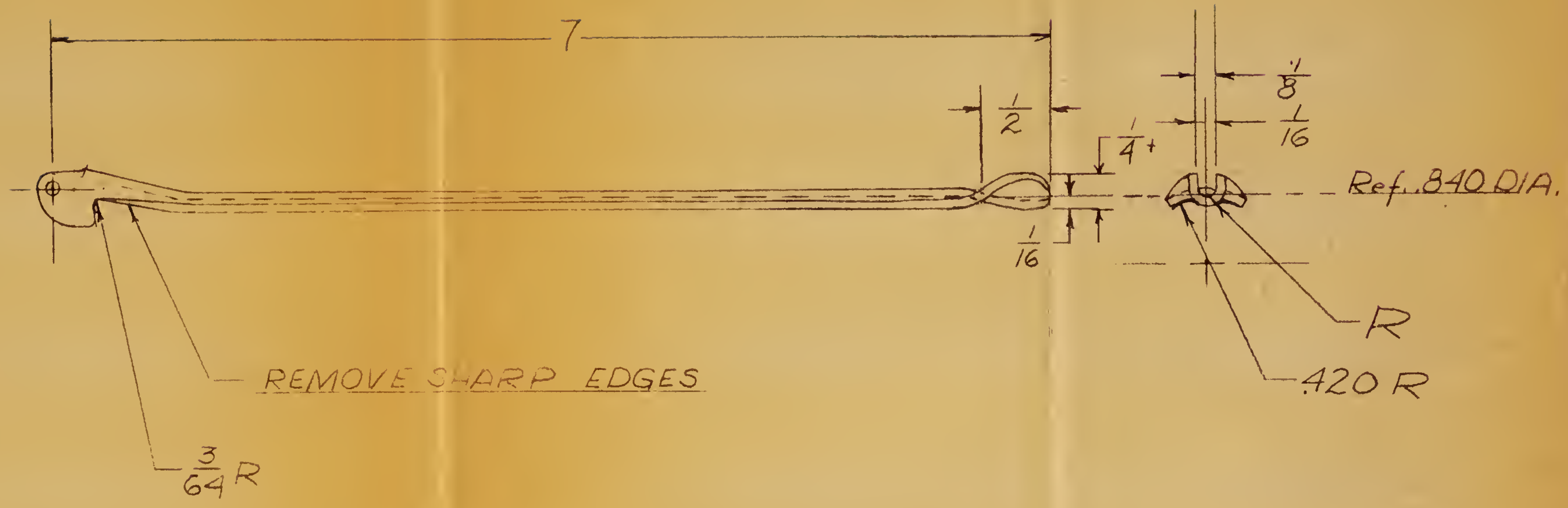
VER,(REVISION)

R		DESIGNED	DRAWN	CHECKED	APPROVED
	NAME	SB	SB	WK	
LY	DATE		4/20/68		

KT ASSEMBLY NO.	PROJECT DRAWING NO.
	K6120-B-023

-B-



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SYM.	DATE	DESCRIPTION OF REVISION	NAME

IIT RESEARCH INSTITUTE
TECHNOLOGY CENTER CHICAGO, ILLINOIS 60616

MATERIAL CRS - 1045

HEAT TREAT

LEVER, (REVISION)

TOLERANCES
UNLESS OTHERWISE SPECIFIED
FRACTIONS ± 1/64 DECIMALS ± .005
THDS CLASS 2 FIT ANGULAR ± 1°

DO NOT SCALE - REPORT ERRORS
BREAK ALL SHARP CORNERS
C'SINK ALL TAPPED HOLES 1/32 x 45°
REMOVE BURRS

FINISH
√
UNLESS OTHERWISE NOTED

QUANTITY PER

SUB-ASSEMBLY

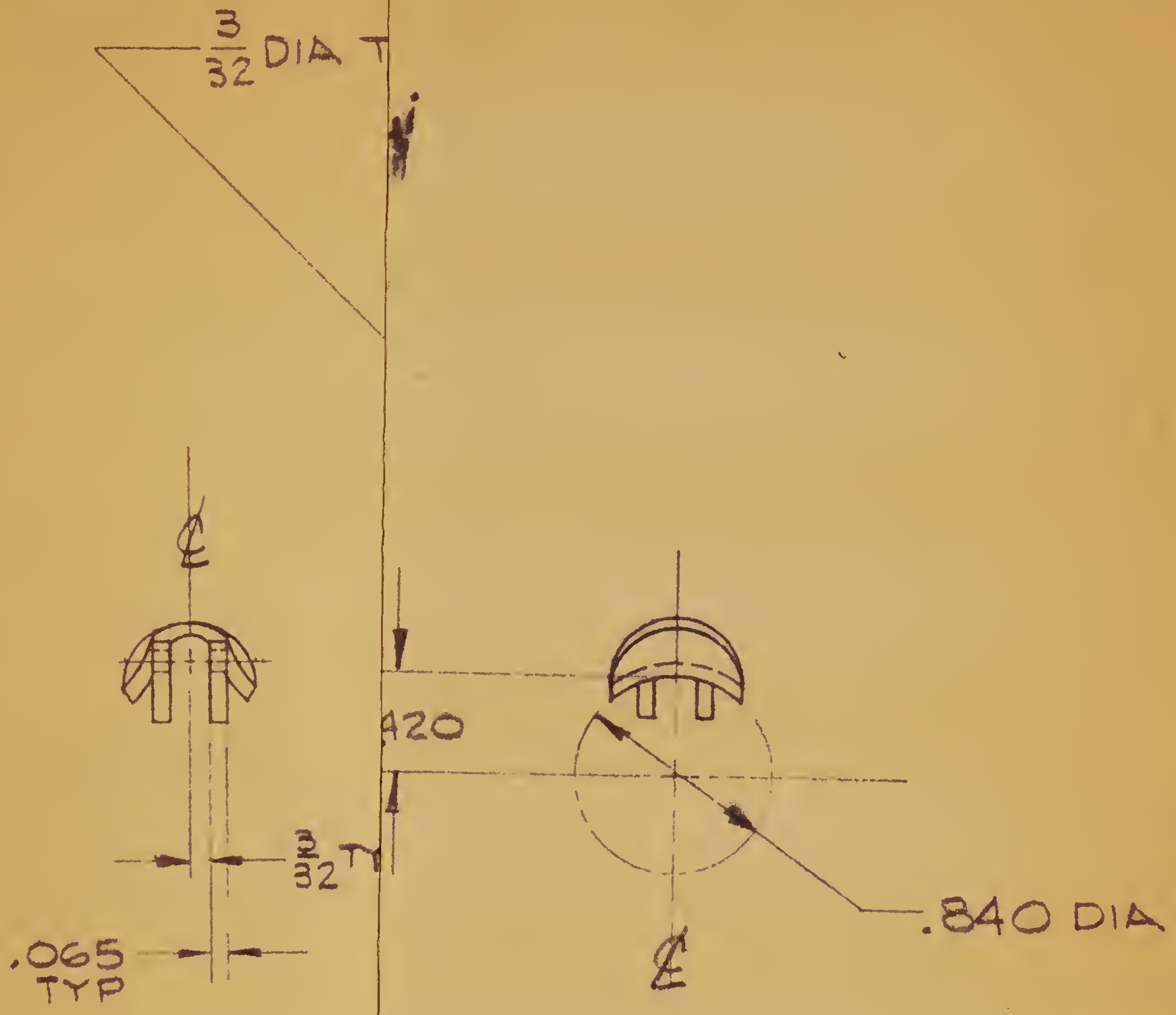
	DESIGNED	DRAWN	CHECKED	APPROVED
NAME	SB	SB	WK	
DATE		4/20/68		

SCALE 1:1

NEXT ASSEMBLY NO.

PROJECT DRAWING NO. K6120-B-023

-B-



DESCRIPTION OF REVISION	NAME

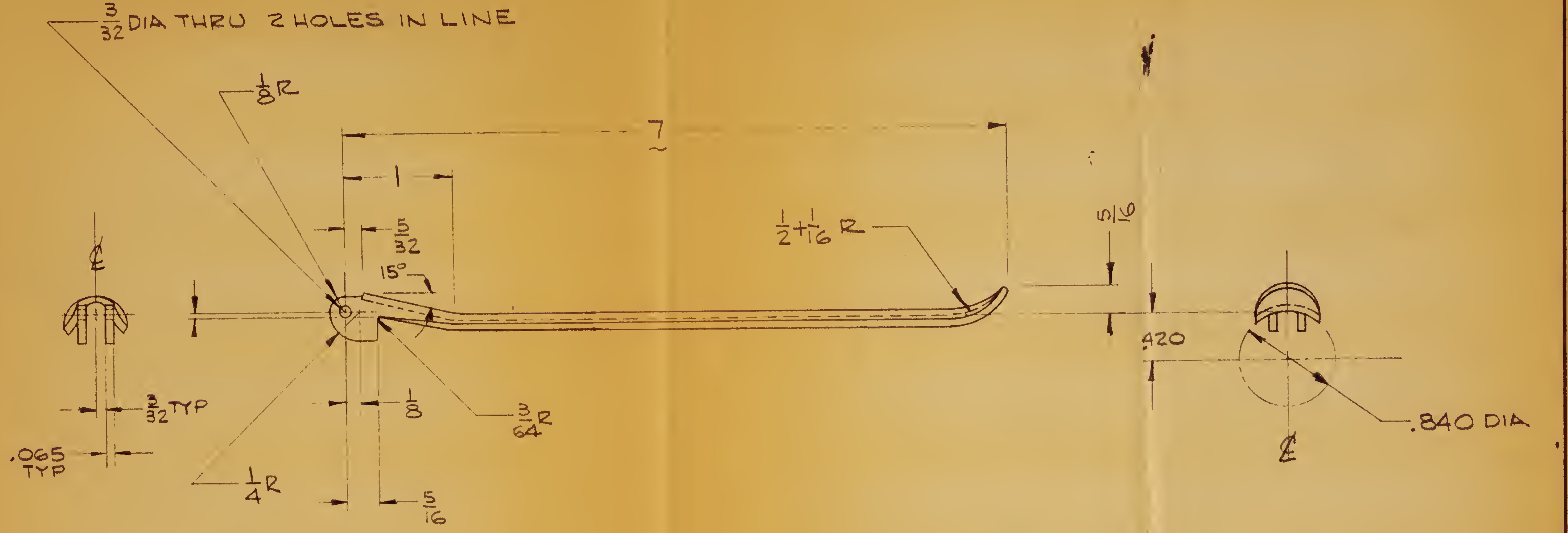
RESEARCH INSTITUTE
CENTER CHICAGO, ILLINOIS 60616

LEVER (PRESENT)

R		DESIGNED	DRAWN	CHECKED	APPROVED
	NAME	SB	Rp		
Y	DATE		4/29/68		

T ASSEMBLY NO.	PROJECT DRAWING NO.
	K6120-B-023-1

-B-



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SYM.	DATE	DESCRIPTION OF REVISION	NAME

IIT RESEARCH INSTITUTE
TECHNOLOGY CENTER
CHICAGO, ILLINOIS 60616

MATERIAL
NO. 16 (.065) HOT ROLLED STRIP
HEAT TREAT

LEVER (PRESENT)

TOLERANCES
UNLESS OTHERWISE SPECIFIED
FRACTIONS ± 1/64 DECIMALS ± .005
THDS CLASS 2 FIT ANGULAR ± 1°

DO NOT SCALE - REPORT ERRORS
BREAK ALL SHARP CORNERS
C'SINK ALL TAPPED HOLES 1/32 x 45°
REMOVE BURRS

FINISH
√
UNLESS OTHERWISE NOTED

QUANTITY PER
1
SUB-ASSEMBLY

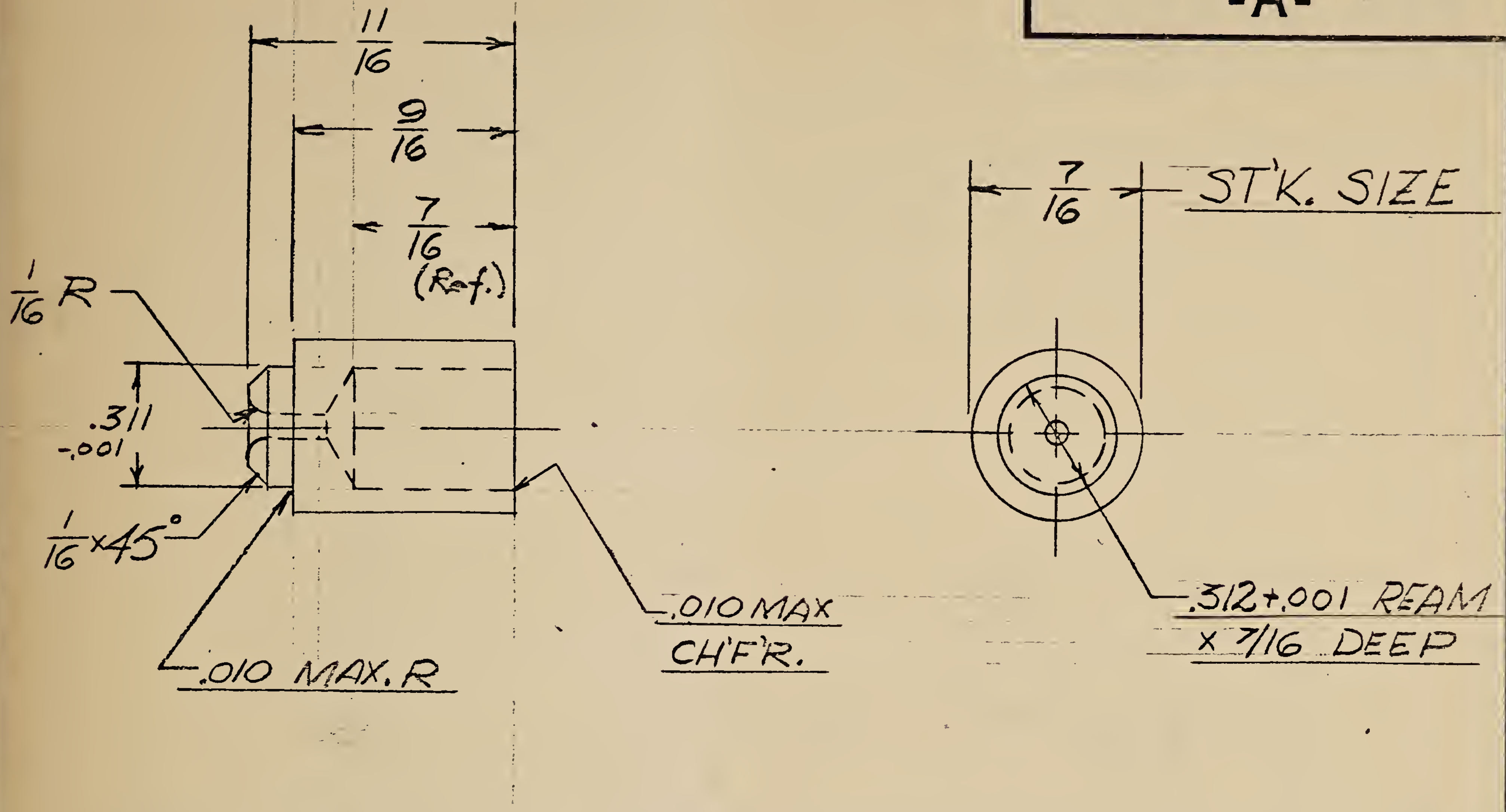
	DESIGNED	DRAWN	CHECKED	APPROVED
NAME	SB	Rp		
DATE		4/29/68		

SCALE: FULL

NEXT ASSEMBLY NO.

PROJECT DRAWING NO.
K6120-B-023-1

-A-



NOTE: WHITE ANODIZE - 43 PIECES/CANE

BRIGHT RED ANODIZE - 12 PIECES / CANE

ALL DIAS. WITHIN .005 ⊙ T.I.R.

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SYM.	DATE	DESCRIPTION OF REVISION	NAME

IIT RESEARCH INSTITUTE
TECHNOLOGY CENTER
CHICAGO, ILLINOIS 60616

MATERIAL
2024 S T-3 ALUM.

HEAT TREAT

SEGMENT, SMALL

TOLERANCES
UNLESS OTHERWISE SPECIFIED
FRACTIONS ± 1/64 DECIMALS ± .005
THDS CLASS 2 FIT ANGULAR ± 1°

DO NOT SCALE - REPORT ERRORS
BREAK ALL SHARP CORNERS
C'SINK ALL TAPPED HOLES 1/32 x 45°
REMOVE BURRS

FINISH
64 √
UNLESS OTHERWISE NOTED

QUANTITY PER

SUB-ASSEMBLY

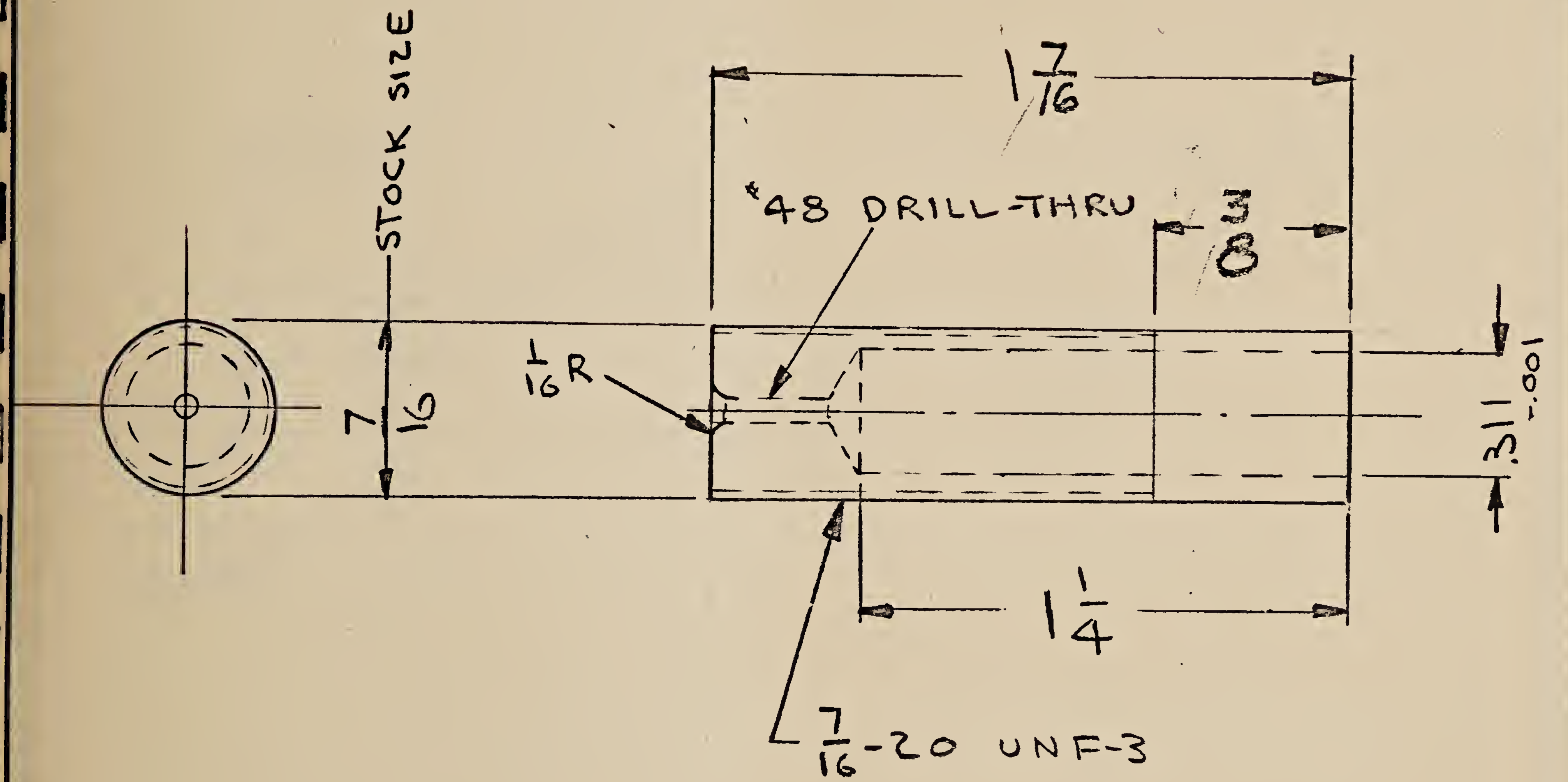
	DESIGNED	DRAWN	CHECKED	APPROVED
NAME	SB	SB	WK.	
DATE				

SCALE
2:1

NEXT ASSEMBLY NO.

PROJECT DRAWING NO.
K6120-A-028

K-6120-A-029



NOTE: WHITE ANODIZE

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SYM.	DATE	DESCRIPTION OF REVISION	NAME

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MATERIAL 2024-T4 ALUM.

HEAT TREAT

SEGMENT -TOP, SHORT

TOLERANCES
UNLESS OTHERWISE SPECIFIED
FRACTIONS ± 1/64 DECIMALS ± .005
THDS CLASS 2 FIT ANGULAR ± 1°

FINISH 64 UNLESS OTHERWISE NOTED

QUANTITY PER

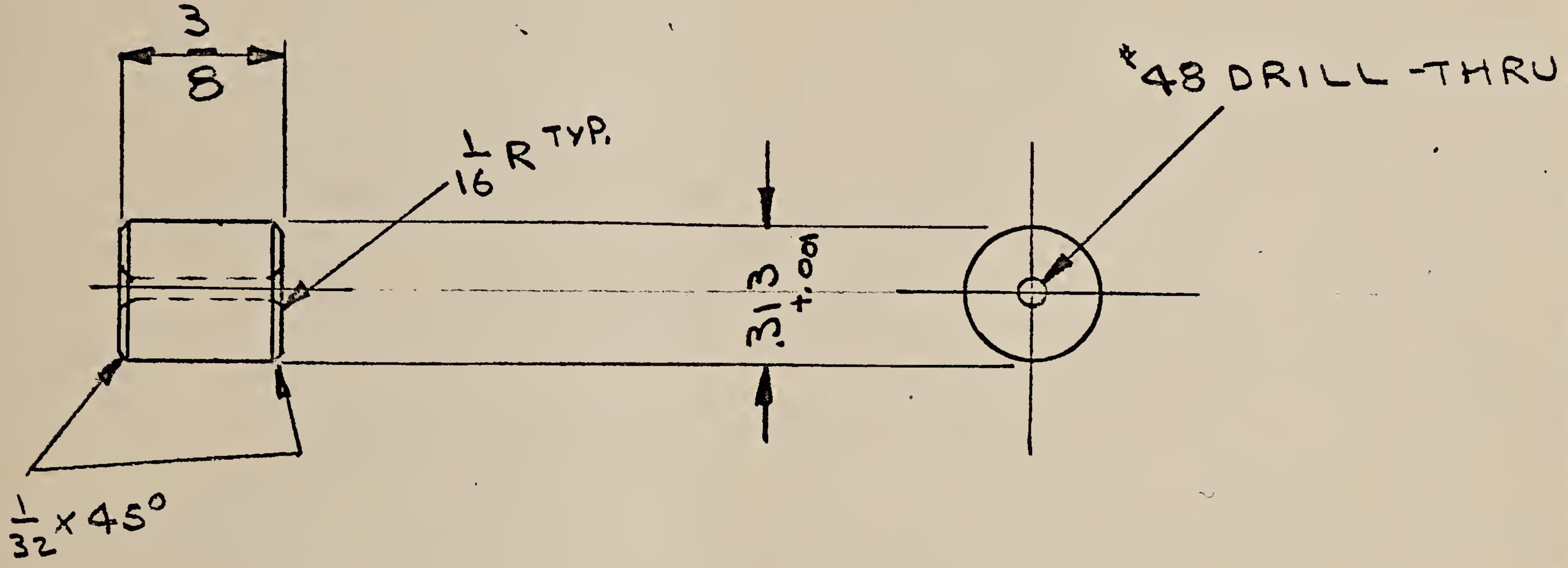
SUB-ASSEMBLY

	DESIGNED	DRAWN	CHECKED	APPROVED
NAME		WK		
DATE		12-1-67		

DO NOT SCALE - REPORT ERRORS
BREAK ALL SHARP CORNERS
C'SINK ALL TAPPED HOLES 1/32 x 45°
REMOVE BURRS

SCALE	NEXT ASSEMBLY NO.	PROJECT DRAWING NO.
2:1		K-6120-A-029

K-6120-A-030



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SYM.	DATE	DESCRIPTION OF REVISION	NAME

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MATERIAL 2024-T4 ALUM

HEAT TREAT

PLUG

TOLERANCES
UNLESS OTHERWISE SPECIFIED
FRACTIONS ± 1/64 DECIMALS ± .005
THDS CLASS 2 FIT ANGULAR ± 1°

DO NOT SCALE - REPORT ERRORS
BREAK ALL SHARP CORNERS
C'SINK ALL TAPPED HOLES 1/32 x 45°
REMOVE BURRS

FINISH 64 √ UNLESS OTHERWISE NOTED

QUANTITY PER 1
SUB-ASSEMBLY

	DESIGNED	DRAWN	CHECKED	APPROVED
NAME		WK		
DATE		12-1-67		

SCALE	NEXT ASSEMBLY NO.	PROJECT DRAWING NO.
2:1		K-6120-A-030